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NEW NORTH AMERICAN BEES OF THE GENUS ANDRENA.

By HENRY L. VIERECK and T. D. A. COCKERELL.¹

The genus *Andrena* is richly represented in Europe, Asia, northern Africa, and North America, the species differing greatly in size and appearance and having diverse flower-visiting habits. Although very many species have been described, it is evident that many more remain to be discovered. The present paper makes known a series, chiefly from the Rocky Mountain Region.

*a*¹. Species with only two submarginal cells.

*a*². Female with yellow face-marks; stigma small.

ANDRENA VERBESINAE, new species.

Cotulla, Texas. May 12, 1906, (F. C. Pratt), on *Verbesina encelioides*.

Female.—Length, 11 mm. Robust. Black; all the tarsi and the anterior and middle tibiae ferruginous. A mark occupying most of clypeus, its lower end trilobed, and very large semicircular lateral marks light yellow. Facial quadrangle a very little broader than long. Process of labrum slightly emarginate. Clypeus shining, well punctured, flattened in middle, with a smooth band; facial foveæ seen from above light ochreous, occupying a little more than half distance between eye and antenna,² below rapidly narrowing,

¹ A number of years ago Mr. Viereck began a revision of the genus *Andrena* as found in North America, and at different times published part of his results, chiefly in the form of tables. The tables for the separation of the groups and species are nearly completed, but the completion of the whole work is unavoidably delayed. It has therefore seemed advisable to publish descriptions of a number of new species, principally from the Rocky Mountains. These species were all recognized as new and given names by Mr. Viereck, and in working over them I have used Mr. Viereck's tables, giving the characters separating them from species previously described as well as from numerous species not yet published. It has been impossible to credit specifically the matter derived from Mr. Viereck's manuscript, but it will be understood that while I am alone responsible for the form of the present paper, it is based upon Mr. Viereck's work and is in every sense a product of our joint labors. All the species which Mr. Viereck regarded as distinct are separately described, although several appear to me to be varietal forms only and are here given as such. Mr. Viereck, on going over the manuscript, writes that he will provisionally accept my opinions on these matters, being at present unable to reinvestigate the questions involved. It is hoped that the account given is sufficiently full to enable students to determine all the forms, whether regarded as varieties or distinct species. The "key" referred to in this paper is that in Mr. Viereck's manuscript. The comments within brackets are mine alone.—T. D. A. COCKERELL.

² This refers, strictly speaking, to the distance between eye and vertical line running through outer edge of antennal socket; hence not necessarily to the breadth of the fovea at transverse level of antenna.

not going below level of antennae. Flagellum bright red beneath, except at base. Third antennal joint much longer than next two together, but not quite so long as next three. Head and thorax abundantly clothed with ochreous hair, becoming ferruginous above. Mesothorax and scutellum dullish, closely punctured; area of metathorax hardly sculptured. Tegulae light reddish. Wings dusky, paler basally. Only two submarginal cells. Stigma very small. Basal nervure meeting transverse median. First recurrent nervure joining second submarginal not far from its beginning. Hair of legs light reddish, dense on tibiae and tarsi. Abdomen shining, well punctured, the broad depressed hind margins of segments pale testaceous, and above this a ferruginous band which is linear on first segment and successively wider on the others, until on the fourth and fifth it forms a patch covering the most of the middle of the segment. All the segments with thin but entire bands of long yellowish hair, and much of same hair at apex, second segment in middle depressed scarcely one-third. The male has clypeus entirely yellow and is without the red bands on abdomen.

(Resembles *Callandrena manifesta*, but is quite distinct according to Mr. Viereck, who had access to the type of *manifesta*.)

Type.—Cat. No. 18119, U.S.N.M.

*b*². Female without light face-marks; head very broad.

ANDRENA PAPAGORUM, new species.

Tempe, Arizona. March 30, at flowers of *Salix*. (Cockerell.)

Female.—Length, 7½ mm. Black, with grayish white hair. Head extremely broad and short. Process of labrum triangular, pointed. Clypeus except at sides brilliantly shining, with very sparse punctures. Facial foveae seen from above brownish white, occupying more than two-thirds space between eye and antenna, ending below at about level of top of clypeus. Flagellum dull brownish beneath, third antennal joint about as long as the next two together. Mesothorax and scutellum brilliantly shining, very sparsely and feebly punctured; area of metathorax granular, scarcely defined. Tegulae dark reddish. Wings hyaline, with only two submarginal cells, the second transverse cubital being absent. Nervures and stigma amber color, first recurrent nervure joining second submarginal at a distance from its base equal to about one-half length of first transverse cubital. Hair on hind tibiae creamy white on outer side and pure white on inner. Abdomen rather narrow, brilliantly shining, without distinct punctures, depressed parts of segments reddish, second segment in middle depressed two-fifths. Hind margins of segments with distinct white hair bands, interrupted in middle on second and reduced to a patch on each side on first, on the under side the bands are also distinct but narrower. Hair at apex cream color. This

falls in the table in a couplet with a species (still undescribed) which differs from it by the dullish, almost impunctate clypeus.

Type.—Cat. No. 18120, U.S.N.M.

(The type of *Andrena coloradina*, variety *A*, described below, has only two submarginal cells on one side.)

*b*¹. Species with three submarginal cells.

*a*³. Species of the subgenus *Trachandrena*.

*a*⁴. Large species with the aspect of *Andrena carlini*; modified part of second abdominal segment extending almost to base of segment in middle; hair of thorax above creamy white.

ANDRENA SWENKI, new species.

Moscow, Idaho, No. 121.

Female.—Length, 13 mm. Robust species, superficially resembling *A. vicina*. Black, with reddish-black hair, but that on mesothorax, scutellum, post-scutellum, tegulae and borders of tubercles creamy white; on underside of anterior femora pallid. Facial quadrangle considerably broader than long. Process of labrum truncate. Clypeus very coarsely and extremely densely punctured, with a median smooth line. Facial foveae seen from above pale grayish brown, occupying a little more than half the space between eye and antenna, below narrowed, and ending about level with top of clypeus or a little lower. Flagellum obscurely reddish beneath. Third antennal joint about as long as the next two combined. Mesothorax and scutellum very coarsely punctured, but the surface largely hidden by hair. Area of metathorax with very strong, rather regular, longitudinal ridges. Tegulae rufo-piceous. Wings dusky hyaline, stigma and nervures dark rufo-fuscous, basal nervure meeting transverse median, second submarginal receiving first recurrent nervure beyond middle. Spurs red. Abdomen shining, the depressed portions of the segments extremely large, that on second in middle occupying at least three-fourths of segment. These depressed parts shining and very sparsely and feebly punctured; the other parts, which broaden laterally, strongly punctured, but first segment slightly punctured all over. No distinct hair bands. In the table it is separated from several allies (*A. striatifrons*, *A. semipunctata*, *A. spireana*) by the distinctly punctured depressed part of second abdominal segment.

Type.—Entomological collection of the University of Nebraska.

*b*⁴. Large species (male), with red hair.

ANDRENA JOCKORUM, new species.

Peck, Idaho, April 8, 1900.

Male.—Length, 12 mm. Black with tarsi reddish apically, pubescence throughout warm reddish ochreous, long and brightly colored on face and thorax above. Malar space very short; process of labrum broad, truncate, shallowly emarginate; clypeus and sides

of face coarsely rugoso-punctate, dullish; facial quadrangle broader than long; cheeks ordinary, not as broad as eyes; vertex dull, with irregular coarse sculpture; antennae stout, black, the flagellum beneath faintly brownish, third antennal joint about as long as fourth but not so long as fifth, apical joint with a smooth shining apical area on inner side. Mesothorax and scutellum dullish, very coarsely and closely punctured; metathorax very coarsely granular, the rather small triangular area with very coarse rugae, the median one reaching its posterior end. Tegulae shining reddish piceous. Wings hyaline, faintly brownish, more distinctly so apically; nervures and the large stigma ferruginous, second submarginal receiving first recurrent nervure in middle.

Abdomen shining, but quite closely punctured except the hind margins and extreme bases of segments; second segment in middle depressed about one-half. No hair bands, but all segments with abundant erect hair, not dense enough to conceal surface.

In the table it is separated from *A. weedi* and *A. radiatula* by the long, dense, nearly erect hair of abdomen.

Type.—Entomological collection of the University of Nebraska.

*c*⁴. Smaller species, not at all like *A. carlini* in aspect.

*a*⁵. Abdomen largely ferruginous.

*a*⁶. Female; mesothorax moderately shiny; second abdominal segment in middle depressed much more than half; second submarginal not narrow.

ANDRENA SUBMARIAE, new species.

Hamilton County, Kansas. 3,350 feet. (F. H. Snow, 326.)

Female.—Length, 8 mm. Head and thorax black. Legs dark reddish, the hind tibiae and tarsi clear ferruginous. Abdomen bright chestnut red, the hind margins of the segments golden. Beneath, the segments are largely blackened; above are some irregular blackish stains which evidently did not exist in life. Facial quadrangle broader than long; process of labrum truncate; clypeus shining, strongly and closely punctured. Facial foveae seen from above creamy white, occupying more than two-thirds of distance between antenna and eye, below they end a little below level of antennae, and are not widely separated from eye; flagellum with a light red band beneath quite abruptly contrasting with the dark color of the rest of the flagellum; third antennal joint about as long as 4 and 5 together. Front both striate and punctured. Mesothorax and scutellum with large, strong, not dense punctures. Mesothorax dull, scutellum more shining. Area of metathorax with rather fine longitudinal ridges which send out lateral branches. Tegulae rather light reddish. Wings reddish hyaline, stigma and nervures clear ferruginous, basal nervure meeting transverse median, second submarginal receiving first recurrent nervure well beyond middle. Scopa of hind tibiae

creamy white; hair on inner side of hind tarsi light red brown. Abdomen shining, sparsely punctured, without hair bands, second segment in middle depressed more than half, but feebly. Hair at apex pale, but suffused with golden.

Female.—Clear Creek, Colorado. (Baker, 5836.)

Differs from Kansas type as follows: Flagellum without any red band or stripe beneath. Third antennal joint considerably longer and more slender, though not as long as the next three joints combined. Area of metathorax more irregularly wrinkled. Sides of mesothorax posteriorly more sparsely punctured. Basal nervure falling short of transverse median. First abdominal segment more strongly punctured. Hind tibiae and base of tarsi quite dark, not clear ferruginous.

(I believe this Colorado *A. submariae* to be the female of *A. martialis*, and probably specifically distinct from the Kansas type.)

Paratype.—Cat. No. 18137, U.S.N.M.

♂. Males; mesothorax dull; second abdominal segment in middle depressed about half, the edge of the depression little curved. (The difference between this and *A. submariae* in respect to the depression of second segment is sexual, as proved by the sexes of *A. sphecodina* taken together.) Second submarginal cell very narrow.

A. martialis is probably a subspecies of *A. sphecodina*. The males concerned may be separated thus:

Head narrow; basal nervure meeting transverse median; first abdominal segment with very small punctures.....*sphecodiniformis*.

Head broad; basal nervure falling short of transverse median; first abdominal segment distinctly punctured.....*martialis*.

Very close to *martialis*, but area of metathorax seems duller and not so heavily ridged.....*sphecodina*

A. martialis can not be separated from *sphecodiniformis* on the character of abdominal fasciation.

ANDRENA MARTIALIS, new species.

Boulder, Colorado. March 25. (G. M. Hite.)

Male.—Length, $7\frac{1}{2}$ mm. Black, with the apical third of the first abdominal segment and nearly all of the second and third bright ferruginous. The second and third with a transverse blackish shade at base and the third more or less blackened apically. Small joints of tarsi brownish. Pubescence grayish white. Facial quadrangle broader than long. Process of labrum truncate. Clypeus finely but closely punctured, with a delicate median ridge. Antennae dark, but joints 3 to 6 more or less red beneath; third joint a little shorter than fourth. Cheeks normal. Mesothorax and scutellum dullish, with strong but not large punctures. Area of metathorax triangular, with strong irregular ridges. Tegulae dark reddish. Wings reddish hyaline. Stigma and nervures ferruginous. Basal nervure almost meeting transverse median. Second submarginal cell very narrow,

receiving first recurrent nervure well beyond middle. Third submarginal very broad. Abdomen with extremely minute punctures. Hair bands not well defined. Second segment in middle depressed nearly one-half, but feebly. Apical plate narrow, broadened at end, truncate.

ANDRENA SPHECODINIFORMIS, new species.

Platte Canyon, Colorado. (Baker, 5829.)

Male.—Length, about $6\frac{1}{2}$ mm. Head and thorax black; legs black, tarsi obscure reddish; abdomen brownish ferruginous, the first dorsal segment with more than the basal half black, the margin of the black suffused; second segment with oval black spot on each side; subapical region broadly suffused with black. Pubescence rather dull white, long on head and thorax, dense on clypeus, which is well punctured, but shining between the punctures. Process of labrum broad, truncate. Eyes somewhat converging below, so that the lower side of the facial quadrangle is not greater than its length; vertex dullish; cheeks normal; antennae black, the flagellum with the joints beyond the first brownish beneath, the second to fourth light reddish, third antennal joint about as long as fourth, fifth distinctly longer; malar space short; mesothorax and scutellum dullish, with sparse very feeble punctures; metathorax roughened, the triangular basal area with strong long plicae. Tegulae reddish; wings hyaline, faintly reddish, strongly iridescent; stigma amber color, nervures fuscous. Second submarginal cell very small, third submarginal not much elongated. Abdomen shining, without distinct punctures. Second segment in middle depressed about one-half. Hair of abdomen rather scanty, not forming bands.

Type.—Cat. No. 18123, U.S.N.M.

*b*⁵. Abdomen not at all ferruginous.

*a*⁷. Males.

*a*⁸. Second abdominal segment in middle depressed over one-half; pubescence red.

ANDRENA DAVISIANA, new species.

Boulder, Colorado. May 8, 1907. (J. M. Davis.)

Male.—Length, $7\frac{1}{2}$ mm. Black with fulvous pubescence, bright on thorax above. Head broad. Process of labrum truncate. Clypeus strongly and densely punctured. Antennae dark, third joint shorter than fourth. Cheeks normal. Mesothorax and scutellum shining, with irregular rather small punctures. Area of metathorax, with irregular rather weak ridges. Tegulae reddish. Wings reddish hyaline; nervures and the very large stigma ferruginous, basal nervure falling short of transverse median, second submarginal receiving first recurrent nervure a little beyond middle. Small joints of tarsi ferruginous. Abdomen very finely punctured, not distinctly banded. Second segment in middle depressed about three-fifths. Apical plate small.

A. tacitula has a similar red-haired form (*grossulariae*), but it has a different area of metathorax and different venation.

*b*⁸. Second abdominal segment in middle depressed less than one-half.

*a*⁹. Stigma and nervures clear amber; second submarginal receiving first recurrent nervure near end; hind tarsi clear red. (Area of metathorax much more coarsely sculptured than in *A. claytoniae*.)

ANDRENA CRATAEGIPHILA, new species.

Boulder, Colorado. May 10, at flowers of *Crataegus coloradensis* Nelson. (T. D. A. Cockerell.)

Male.—Length, 7½ mm. Black, with pale ochreous hair. Facial quadrangle broader than long. Eyes diverging above. Process of labrum truncate. Clypeus very densely punctured. Antennae long. Flagellum dark brown beneath; third antennal joint not quite as long as fourth. Cheeks normal. Mesothorax dullish, with small shallow punctures. Scutellum more shining. Area of metathorax shining, with strong longitudinal ridges. Tegulae rufopiceous. Wings dusky hyaline, nervures and the large stigma ferruginous; basal nervure falling just short of transverse median. Second submarginal small, receiving the first recurrent nervure near its end. Small joints of all the tarsi, and hind tarsi entirely, clear ferruginous. Abdomen convex, shining, without distinct punctures. Narrow hind margins of segments testaceous. Second segment in middle depressed about one-third. Sides of second and following segments with rudimentary hair bands. Apical plate with a rather rounded truncation.

ANDRENA CRATAEGIPHILA, variety.

Boulder, Colorado. March 30, at *Salix bebbiana*. (S. A. Rohwer.)

Male.—Length, 9 mm. Black, with pale slightly ochreous pubescence. Facial quadrangle broader than long. Process of labrum truncate. Clypeus shining but densely punctured. Facial foveae seen from above white, extremely narrow, hardly as broad as the width of an ocellus. Flagellum thick, bright ferruginous beneath. Third antennal joint about as long as fourth. Cheeks normal. Mesothorax dullish, with small not dense punctures. Scutellum shining, sparsely punctured. Area of metathorax with large irregular wrinkles. Tegulae rufopiceous. Wings reddish hyaline, nervures and the large stigma ferruginous, basal nervure falling a little short of transverse median, second submarginal broad, receiving first recurrent nervure at its end. Small joints of anterior and middle tarsi, hind tarsi entirely and a large part of hind tibiae ferruginous. Abdomen very finely punctured, extreme hind margins of second and following segments red. Second segment in middle depressed about one-third. Rudimentary hair bands at sides of second and

following segments. Apical plate broadly truncate. (This is labeled as a new variety of *A. imitatrix*. It is larger than *A. crataegiphila*, with redder stigma and broader second submarginal, but I believe certainly no more than a variation.)

ANDRENA PROFUNDIFORMIS, new species.

Fort Collins, Colorado. (Gillette.) October 5, 1901.

Male.—Length 8 mm. Black, small joints of tarsi light reddish; first two abdominal segments ferruginous at the extreme sides, the red area of the second enclosing a black spot; hair very pale ochreous, long on head and thorax; facial quadrangle broader than long; process of labrum broadly truncate; clypeus closely punctured; malar space short; cheeks normal; vertex depressed at sides; antenna black, flagellum faintly brownish beneath. Third antennal joint distinctly shorter than fourth, which is shorter than fifth. Mesothorax and scutellum dullish, rather strongly punctured; mesothorax anteriorly with three well marked longitudinal grooves. Metathorax rather small, roughened, very hairy, the rather poorly defined area with very strong longitudinal rugae, the three middle ones especially prominent. Tegulae testaceous. Wing hyaline, faintly dusky. Stigma reddish amber, nervures more fuscous, basal nervure meeting transverse median. First recurrent nervure joining the rather large second submarginal considerably beyond middle.

Abdomen shining, feebly punctured, second segment in middle depressed a little less than one-half, the depressed portions of the segments obscurely reddish. Hair of abdomen short and sparse, tending to form bands at sides of segments 2 and 4.

Type.—Cat. No. 18126, U.S.N.M.

This has darker hind tarsi than *A. crataegiphila*. In the table, the two species are separated thus:

Second abdominal segment depressed decidedly less than one-half. . . . *crataegiphila*.

Second abdominal segment depressed a little less than one-half. . . . *profundiformis*.

♂⁹. Stigma and nervures chestnut red; second submarginal cell receives first recurrent nervure near middle, or if beyond, not near end; hind tarsi not clear red.

(The basal nervure meets, or almost meets, transverse median; in *davisiana* it falls considerably short of it.) Species related to *A. crataegi*, but quite distinct.

ANDRENA TACITULA Cockerell.

Boulder, Colorado. June 4, 1905. (W. P. Cockerell.)

Male.—Length about 7 mm. Black, with uniformly pale ochreous hair. Facial quadrangle only a little broader than long. Process of labrum broadly truncate. Clypeus shining, densely and strongly punctured, with a delicate median raised line. Antennae dark, the sutures between the joints deep, third joint short, about as long as fourth. Vertex strongly punctured. Cheeks normal. Mesothorax and scutellum shining, strongly punctured. Area of metathorax with

fine but well marked longitudinal ridges. Tegulae dark reddish. Wings dusky hyaline, nervures and stigma dark ferruginous. Basal nervure meeting transverse median. Second submarginal receiving first recurrent nervure just beyond middle. Abdomen shining, with small but very distinct punctures. Hind margins of third to fifth segments with hair bands and the same at sides of second. Second segment in middle depressed about two-fifths. Hair at apex very pale yellowish. Apical plate truncate.

ANDRENA TACITULA, variety.

Topaz Butte, Colorado. June 17. (S. A. Rohwer.)

Male.—Length, 8 mm. Black. Pubescence vary pale ochreous. Head very broad. Mandibles red at end. Clypeus shining, strongly and closely punctured. Antennae dark, third joint a little longer than fourth. Cheeks normal. Vertex strongly punctured. Mesothorax and scutellum shining, with strong and only moderately large punctures, well separated on middle of mesothorax, irregularly confluent on scutellum. Area of metathorax with numerous strong ridges. Tegulae rufopiceous. Wings reddish hyaline. Basal nervure almost reaching transverse median. Second submarginal cell broad, receiving first recurrent nervure well beyond middle. Small joints of tarsi ferruginous. Abdomen finely punctured, with short thin hair and distinct bands at sides of segments. Second segment in middle depressed nearly one-half. Apical plate truncate.

(This was given as a distinct species, but I believe it to be conspecific with *A. tacitula*.)

ANDRENA TACITULA GROSSULARIAE, new variety.

Topaz Butte, Colorado. June 17. S. A. Rohwer.

Male.—Length, 8 mm. Black. Tarsi ferruginous apically, mandibles dark chestnut red at apex. Pubescence throughout warm reddish ochreous, long and bright on scutellum. Head ordinary, facial quadrangle broader than long, process of labrum shallowly emarginate. Clypeus rugosopunctate; vertex dull and granular; cheeks rather broad; antennae black, flagellum obscurely brownish beneath; third antennal joint about as long as fourth; fifth only a trifle longer; mesothorax closely punctured, but shining on disk between the punctures; metathorax dull and roughened, except the rather large triangular basal area, which is well defined, moderately shining, and covered with weak irregular longitudinal wrinkles.

Wing hyaline, faintly dusky apically, nervures and stigma rather dusky ferruginous. Basal nervure meeting transverse median, whereas in *A. jockorum* it goes basal of it. First recurrent nervure joining second submarginal about the middle. Third submarginal not so long as in *A. jockorum*.

Abdomen broad, moderately shining, well punctured, second segment depressed one-half in middle. First segment with median apical, longitudinal groove. Hair of abdomen short and thin, but covering segments, becoming a little thicker at the apices of segment laterally so as to suggest imperfect bands.

(This is a red-haired variety of *A. tacitula*.)

Type.—Cat. No. 18124, U.S.N.M.

*b*⁷. Females.

*a*¹⁰. Scutellum excessively densely and strongly punctured; wings dark.

ANDRENA PERDENSE Viereck.

Westlake, Colorado. July 7, 1900.

Female.—Length, 11½ mm. Black, with short pale ochreous hair on head and thorax above, tubercles, sides of metathorax and anterior femora beneath. Hair on legs mostly sooty, but orange ferruginous on inner side of anterior tarsi, in complete contrast with the black hair of middle tarsi (hind tibiae and tarsi missing). Facial quadrangle rather longer than broad. Process of labrum broadly rounded; clypeus dull, strongly and closely punctured, the lower half with a median smooth line sides of face closely punctured. Facial foveae as seen from above brown-white, occupying rather more than one-half distance between eye and antenna, but rapidly narrowing below, so that at level of antennae they are very narrow, ending little separated from eye, at about level of top of clypeus. Flagellum obscure brownish beneath; third joint hardly as long as next two combined. Mesothorax and scutellum very densely and coarsely punctured. Area of metathorax with very strong and well-defined ridges, some of them zig-zag. Tegulae large, ferruginous, with a large fuscous patch. Wings strongly brownish, nervures and stigma dark reddish. Basal nervure falling just short of transverse median. Second submarginal receiving first recurrent nervure well beyond middle. Spurs pale ferruginous. Abdomen strongly and quite closely punctured, without hair bands. Second segment in middle depressed about three-fifths. Hair at apex dark fuscous.

A specimen from Vernon, British Columbia, labelled *perdensa*, is a different species. It differs from Colorado *A. perdensa* by the shining clypeus, truncate process of labrum, smaller and not quite so coarsely sculptured area of metathorax, basal nervure meeting transverse median, third submarginal cell longer. The hind tibiae and tarsi are present in this specimen and have brown-black hair.

Collected June 21, 1903.

The original *A. perdensa* came from British Columbia, so perhaps the Colorado insect is not truly of that species.

*b*¹⁰. Scutellum with distinctly separated punctures.

*a*¹¹. Hind tibiae and tarsi black or nearly; second abdominal segment depressed in middle more than half; hair at apex of abdomen pale reddish.

ANDRENA CYANOPHILA Cockerell.

Florissant, Colorado. July 5, 1907. At flowers of *Argentina anserina*. (S. A. Rohwer.)

Female.—Length, $9\frac{1}{2}$ mm. Black, with pale ochreous pubescence, becoming white beneath. Facial quadrangle a little broader than long. Process of labrum narrowly truncate. Clypeus shining, coarsely and confluent punctured, with a smooth median line. Facial foveae seen from above white, rather broad, below going below level of antennae. Flagellum dark reddish beneath. Third antennal joint about as long as next two combined. Mesothorax and scutellum shining, with extremely large punctures. Area of metathorax with sharp irregular ridges. Tegulea dark reddish. Wings dusky hyaline. Stigma and nervures dark reddish. Basal nervure meeting transverse median. Second submarginal receiving first recurrent nervure beyond the middle. Hair on hind tibiae white, on inner side of hind tarsi light orange. Abdomen shining, the nondepressed portions closely punctured, second segment in middle depressed almost three-fourths. Imperfectly developed hair bands at sides of second and following segments. Hair at apex light ochreous.

This species is close to *A. hippotes*, but distinct.

ANDRENA CYANOPHILA, variety.

Fort Collins, Colorado. June 22, 1899. (Gillette.)

Female.—Length, $9\frac{1}{2}$ mm. Black, including the legs. Pubescence grayish white with a slight ochreous tinge. Facial quadrangle about as broad as long. Process of labrum truncate. Clypeus shining, strongly and closely punctured, with a strong median raised line. Facial foveae seen from above snow white, occupying about half the space between eye and antenna; below narrower, reaching about to level of top of clypeus, separated from eye by a narrow shining band. Flagellum stained with bright chestnut red beneath. Third antennal joint hardly as long as the next two combined. Mesothorax and scutellum shining, with large and deep irregularly placed punctures. Metathorax entirely dull, swollen at sides, the area well defined, with very strong irregular wrinkles and sharply cut off behind by a slender transverse ridge. Tegulae reddish, wings reddish hyaline, stigma and nervures dark rufous. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure well beyond the middle, hair on outer side of hind tibiae white, on inner side of hind tarsi pale reddish. Abdomen shining, very distinctly but rather finely punctured. Second segment depressed in middle more than two-thirds; rudimentary white hair bands at sides of segments 2–5. Apical hair light golden.

(This was given as a distinct species, but I believe it to be conspecific with *cyanophila*.)

δ^{11} . Hind tibiae and tarsi red.

α^{12} . Mesopleura granular; mesothorax with small punctures.

ANDRENA TRUMANI, new species.

Volga, South Dakota.

Female.—Length, 10 mm. Black, with grayish-white hair. Hind tibiae and middle and hind tarsi clear ferruginous. Facial quadrangle broader than long. Process of labrum short, emarginate. Clypeus microscopically tessellate, strongly and closely punctured, with a median impunctate line, the lower part of which is smooth and shiny. Facial foveae seen from above grayish-white, occupying about two-thirds space between eye and antenna; below they extend rather broadly, a short distance below level of antennae. Antennae dark; third joint a little longer than the next two combined. Mesothorax dullish, with rather small not very dense punctures; hindpart of mesothorax and scutellum more shining, very sparsely punctured. Sides of mesothorax very densely fringed with hair, the area broad triangular, irregularly wrinkled. Tegulae reddish. Wings quite dusky, with a reddish tint. Stigma and nervures ferruginous, stigma very bright. Basal nervure meeting transverse median. Second submarginal large, receiving first recurrent nervure about middle. Hair on hind tibiae cream color. Abdomen with small but very distinct and numerous punctures. Hind margin of first segment narrowly red. Segments 2-4 with thick white hair bands, that on 2 interrupted in middle. Hair at apex light reddish. Second segment in middle depressed more than one-third, but less than one-half.

Type.—Collection of the American Entomological Society.

♂¹². Mesopleura with small punctures; mesothorax with very small punctures.

ANDRENA TITUSI, new species.

Fort Collins, Colorado. May 7, 1901. (Titus.)

Female.—Length, 10 mm. Black, rather slender. The small joints of tarsi, middle and hind basitarsi and hind tibiae clear ferruginous. Pubescence grayish white, faintly ochraceous. Facial quadrangle broader than long. Process of labrum narrow at apex, not emarginate. Clypeus shining, strongly and quite closely punctured, with a median smooth line. Facial foveae white, occupying about two-thirds distance between eye and antenna, ending narrowly below at about level of top of clypeus. Flagellum obscurely brownish beneath; third joint long, a little longer than next two together, but not so long as next three. Mesothorax somewhat shining, rather closely punctured. Area of metathorax small, coarsely, very irregularly wrinkled, all other parts of metathorax very densely hairy. Tegulae dark brown. Wings reddish hyaline. Stigma and nervures reddish amber. Basal nervure meeting transverse median. The broad second submarginal receiving first recurrent nervure very near its end. Spurs cream color. Hair on hind tibiae very pale clear yellow-

ish. Abdomen shining, with extremely minute punctures, these practically absent on segments beyond middle. Hind margins of segments 2-4 with white hair bands, broadly interrupted in middle on 2 and 3. Hair at apex light reddish. Second segment in middle depressed more than one-third; but much less than half.

Type.—In the Titus collection.

*c*¹². Mesopleura strongly punctured.

*a*¹³. Rugae of area of metathorax rather fine.

ANDRENA LINCOLNI, new species.

Lincoln, Nebraska. April.

Female.—Length, about 10½ mm. All the tibiae and the tarsi bright ferruginous, the anterior tibiae somewhat suffused with dusky. Pubescence very pale ochereous, on underparts almost white. Facial quadrangle broader than long. Mandibles, process of labrum (broadly truncate) and lower margin of clypeus entirely dark red. Clypeus shining, with strong rather dense punctures; no smooth median line. Facial foveae seen from above yellowish white, occupying two-thirds distance between eye and antenna; below they end at about level of top of clypeus. Front punctured; flagellum dark reddish; third antennal joint hardly as long as next two combined. Mesothorax and scutellum with very strong rather close punctures. Area of metathorax with strong, rather regular, long wrinkles, and bounded behind by a sharp transverse ridge. Tegulae reddish. Wings dusky hyaline, stigma and nervures chestnut red; basal nervure meeting transverse median; second submarginal cell rather small, receiving first recurrent nervure well beyond middle. Hair on hind tibiae white. Abdomen finely and closely punctured, hind margins of segment dark; second segment in middle depressed a little more than one-half. Segments 2-4 with dense white hair bands, broadly interrupted on 2 and narrowly on 3. Hair at apex pale ferruginous.

Type.—Entomological collection of the University of Nebraska.

*b*¹³. Rugae of area of metathoracic large and coarse.

ANDRENA MOSCOVENSIS, new species.

Moscow, Idaho.

Female.—Length, 10 mm. Black. Hair dull white. Facial quadrangle broader than long. Process of labrum truncate. Clypeus shining, strongly and closely punctured, without any smooth line. Facial foveae seen from above grayish-white, occupying at least two-thirds distance between eye and antenna, and almost reaching lateral ocelli; beneath they taper to an obtuse point below level of top of clypeus, little separated from eye. Flagellum beneath reddish brown, the color rather bright near the apex. Third antennal joint shorter than the next two combined. Middle of front shining and punctured.

Mesothorax and scutellum with very large sparse punctures. Area of metathorax not defined, with very large coarse wrinkles. Pleura strongly and closely punctured. Tegulae partly piceous and partly light red. Wings reddish hyaline, nervures and the large stigma ferruginous, the stigma very brightly colored. Basal nervure going a little basal of transverse median. Second submarginal receiving first recurrent nervure beyond middle. Legs obscurely reddish, the middle and hind tarsi clear ferruginous. Hair of hind tibiae and tarsi pale, that on inner side of tarsi light ferruginous. Abdomen shining, with distinct small punctures and without distinct hair bands; hair at apex reddish golden; second segment in middle depressed fully one-half.

Type.—Entomological collection of the University of Nebraska.

In the table the two last species fall as follows:

Abdomen fasciate:

Hind tibiae and tarsi blackish or dark brown.....*forbesii*.

Hind tibiae and tarsi stramineous.....*lincolni*.

Abdomen not fasciate:

Hind tibiae and tarsi blackish or dark brown.....*mariae* var. *concolor*.

Hind tibiae and tarsi stramineous.....*moscovensis*.

*b*³. Not *Trachandrena*.

*a*¹⁴. Abdomen red, wholly or in part, with pale ochreous hair-bands.

ANDRENA CARRIKERI, new species.

Lincoln, Nebraska. April 25, 1901. On willow. (M. A. Carriker.)

Male.—Length, 12 mm. Black, the abdomen from the apical margin of the first segment to the fourth ferruginous, the segments, especially the fourth, more or less stained with blackish. All the tarsi clear red, hind tibiae red stained with blackish. Hair of head and thorax long and abundant, bright ochreous, becoming light ferruginous in scutellum. Head very large and broad, facial quadrangle much broader than long; process of labrum broad and emarginate; mandibles long and curved downward and with a downwardly directed tooth beneath at base. Antennae long and slender. Flagellum obscure brown beneath. Third antennal joint not quite twice as long as fourth and little longer than the fifth. Clypeus entirely hidden by dense hair; sides of front dull and striate; cheeks shining, very broad, triangular, produced to nearly a right angle behind. Mesothorax dull in front, shining behind. Scutellum shiny. Area of metathorax coarsely granular in middle but its lateral margins broadly shining. Tegulae dark brown. Wings brownish hyaline. Stigma dark chestnut, nervures ferruginous. Basal nervure falling far short of transverse median. Second submarginal cell receiving first recurrent nervure near its end. Spurs ferruginous. Abdomen shining, not punctured, with long loose hair, the hind margins of the segments with thin pale yellowish bands, emphasized by the pallid

color of the tegument beneath. Second segment in middle depressed little more than one-fourth. Apical plate rounded.

Type.—Entomological collection of the University of Nebraska.
This does not have the finely punctured abdomen of *A. prunorum*.
In the key this runs in a couplet with *A. tridens*, being separated thus:

- Abdomen black.....tridens.
- Abdomen black and reddish.....carrikeri.

These two are separated from several others by the polished scutellum.

- b¹⁴. Abdomen not red.
- a¹⁵. Species with blue or green color, and without light tegumentary face-markings.
- a¹⁶. Relatively large, robust species, suggesting *A. mimetica*.
- a¹⁷. Hair of thorax (female) all black.

ANDRENA BRUNERI, new species.

Laramie, Wyoming. “6, 9, 93.” Collected by Professor Buffum, as we are informed by Prof. A. Nelson, who believes that the date is to be read June 9.

Female.—Length 10 mm., rather robust, with short black hair. Head black, with front and vertex fine dark blue. Thorax black, with the pleura and metathorax very dark bluish. Legs reddish black, small joints of tarsi distinctly red. Abdomen rich blue, the hind margins of the segments purplish. Facial quadrangle a little broader than long. Process of labrum so narrowly truncate as to be almost pointed. Clypeus distinctly but not densely punctured, with a smooth median line. Front striate. Facial foveae very narrow, seen from above purple-black, occupying less than half the distance between eye and antenna, ending just below level of antennae. Third antennal joint about as long as next two combined. Mesothorax closely and finely punctured. Area of metathorax granular, not distinctly defined. Tegulae dark reddish. Wings hyaline, strongly tinged with orange, the broad apical region dilute fuscous, stigma and nervures bright ferruginous. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure well before the middle. Hind tibial scopa compact. Abdomen shining, without hair bands, very finely but distinctly punctured. Second segment in middle depressed about one-third.

In the key this runs in a couplet with *A. subtilis*, and is separated thus:

- Pubescence black.....bruneri.
- Pubescence ochreous.....subtilis.

- b¹⁷. Hair of thorax (female) light fulvous above, black at sides.

ANDRENA LAWRENCEI, new species.

Sioux County, Nebraska. May. (Lawrence Bruner.)

Female.—Length, 11 mm. Dark blue, the mesothorax and scutellum green, the abdomen shining greenish blue with the hind margins

of the segments reddish. Legs dark red brown, small joints of the tarsi ferruginous. Pubescence black except on occiput, mesothorax, scutellum, post scutellum, and tubercles, where it is reddish ochreous, and on inner side of tarsi, where it is dark reddish. Facial quadrangle much broader than long. Process of labrum large, dark reddish, broadly rounded, with a small median truncation. Clypeus black, shining, with small sparse punctures, no median line or ridge. Facial foveae seen from above red brown, occupying hardly half the distance between eye and antenna, below not going below antennae. Flagellum dull reddish beneath. Third antennal joint longer than next two together but not so long as next three. Mesothorax and scutellum dull and granular; area of metathorax granular; sides of metathorax with long black hair. Tegulae reddish. Wings strongly reddish; nervures and stigma dark ferruginous. Basal nervure meeting transverse median. Second submarginal cell broad, receiving first recurrent nervure much before middle. Hair of hind tibiae sooty, appearing pallid in some lights. Abdomen shining, without distinct punctures. Hair at apex reddish sooty. Second segment in middle depressed about one-third.

In the key this falls in a special group, along with another, still undescribed, species. The group is characterised especially by its attenuated palpi.

*b*¹⁶. Female about 10 mm. long; hair of head (except occiput) black; of thorax above red; abdomen purple; no hair bands.

ANDRENA PURPURINA, new species.

Colorado.

Female.—Length, 11 mm. Dark purplish blue, the clypeus and face black, thorax very dark obscure blue; abdomen quite brilliantly colored a sort of pearly blue when well lighted, but the hind margins of the segments becoming reddish. Legs and underside of abdomen very dark chestnut red. Facial quadrangle broader than long. Eyes small. Process of labrum rather narrowly truncate. Clypeus very prominent, convex, shining, rather strongly punctured, without any smooth line or ridge. Facial foveae seen from above reddish chocolate, occupying little more than half space between eye and antenna, little narrowed below where they end at about level of antennae. Front striate. Flagellum reddish, beneath pruinose. Third antennal joint nearly as long as next three together. Hair of head black, hair of thorax bright fulvous on mesothorax and scutella, otherwise black. Mesothorax and scutellum dull, finely roughened. Area of metathorax granular. Tegulae rufotestaceous. Wings brownish hyaline, stigma and nervures dull ferruginous. Basal nervure falling a little short of transverse median. Second submarginal cell rather narrow, receiving first recurrent nervure about

middle. Abdomen without hair bands or distinct punctures; hairs at apex sooty. Hair of legs brown black.

Type.—Collection of the American Entomological Society.

Superficially like *A. fulvinigra*, agreeing in size and pubescence, but quite distinct by the purple color and strongly projecting clypeus.

c¹⁶. Small female with light orange stigma and nervures.

ANDRENA VEGANA, new species.

Las Vegas, New Mexico. May 4, 1903. On *Salix*. (Cockerell.)

Very much like *A. placitae*, but can not be its female on account of the more shining thorax, quite differently colored venation, etc. (*A. placitae* male agrees with *vegana*, not with *salicinellina*, in the shape of third submarginal cell, but the stigma is chestnut in *placitae*, amber in *vegana*. *A. vegana* (female) has much darker antennae than male *placitae*.)

Female.—Length a little over 6 mm. Black, with a faint greenish tinge on front and abdomen. Pubescence white, slightly ochreous on thorax above. Facial quadrangle a little broader than long. Process of labrum obtusely pointed. Clypeus shining, with sparse feeble punctures. Facial foveae seen from above pale ochreous, occupying a little more than half space between antenna and eye, ending below a little below level of antennae. Flagellum dark reddish brown beneath. Third antennal joint about as long as next two together. Mesothorax and scutellum shining, hardly punctured, contrasting with the dull granular vertex. Area of metathorax granular, tegulae pale reddish; wings hyaline, nervures and stigma light amber. Basal nervure meeting transverse median. Second submarginal cell broad, receiving first recurrent nervure in middle. Small joints of tarsi ferruginous. Abdomen shining, not punctured; second and following segments with well defined creamy white hair bands, on second failing in middle; hair at apex pale golden reddish.

Type.—Cat. No. 18133, U.S.N.M.

In the table *A. vegana* is separated from *A. fragariana* and *A. illinoensis* by the granular metathoracic inclosure, that of the other two being rugulose.

A. subtrita Cockerell, from Nevada, is (female) 9 mm. long, with white hair bands on abdomen. It is easily distinguished from *A. vegana* by its much larger size.

d¹⁶. Small males with flagellum bright ferruginous beneath.

ANDRENA SALICINELLINA, new species.

Clear Creek, Colorado. (No. 5840.)

Male.—Length, 6½ mm. Black, with a distinct bluish metallic tint, the scutellum brassy. Pubescence dull white, faintly yellowish

on thorax above. Head ordinary; facial quadrangle about as wide as long, broadening above; process of labrum truncate; clypeus minutely punctured, almost hidden by dense hair; flagellum except first joint bright ferruginous beneath. Third antennal joint short, but considerably longer than the very short fourth and nearly as long as the fourth and fifth combined. Mesothorax dullish, microscopically tessellate; scutellum shining; area of metathorax blue-black, granular, not distinctly defined. Tegulae light rufotestaceous. Wings reddish hyaline; nervures and the large stigma amber color. Basal nervure meeting transverse median. Second submarginal cell narrow, receiving first recurrent nervure beyond the middle; third submarginal long. Tarsi clear ferruginous. Abdomen shining, not punctured; hind margins of segments light reddish, with thin narrow white hair bands, failing in middle on segments 1 to 3. Second segment in middle depressed little more than one-fourth. Apical plate emarginate, a very long fringe of hair extending beyond it.

In the table this falls in a couplet with *A. nigrae*, from which it is separated by the uniformly blackish (not reddish brown) abdomen.

Type.—Cat. No. 18134, U.S.N.M.

*e*¹⁶. Small males with flagellum dark beneath.

ANDRENA POLYGONI, new species.

Florissant, Colorado. (T. D. A. Cockerell.) Flying around *Ribes*. July 17.

Male.—Length, 6 mm. Black, the dull finely striate front blue-black. Pubescence long and white, dark brown on scape and at sides of face. Mandibles bright red at apex, with a prominent inner tooth; process of labrum broad, truncate; clypeus shiny, with distinct but not dense punctures; cheeks broad; flagellum dark brown beneath. Third antennal joint hardly twice as long as fourth; fifth distinctly longer than fourth. Mesothorax dullish, hardly sculptured; area of metathorax dull and granular. Tegulae rufo-piceous. Wings hyaline, slightly brownish; stigma and nervures dark red brown. Basal nervure falling short of transverse median. Second submarginal cell receiving first recurrent nervure well beyond middle. Hair on inner side of tarsi pale yellowish. Spurs cream color. Abdomen shining, with very minute sparse punctures, the surface more or less hoary with pale hair. The hind margins of segments 3 to 5 and the second at sides with well defined hair bands. Apical plate rather narrow, truncate.

A. polygoni has longer antennae than *salicinellina*, and long black hair at sides of face (the hair of face in *salicinellina* and *placitae* is all white).

A. vegana has light orange stigma and nervures, entirely different from *polygoni*.

A. paenenigra might be sought here, but is described below, as the abdomen is hardly metallic; so also *A. antonitonis*, which has three clear white hair bands.

Type.—Cat. No. 18135, U.S.N.M.

*b*¹⁵. Species without blue or green color, or if so, with light face-markings.

*a*¹⁸. Face-markings light, yellow or white; males.

*a*¹⁹. Clypeus only light.

*a*²⁰. Clypeus white.

ANDRENA VESTALI DOLICHOCERA, new variety.

Sioux County, Nebraska. May.

Male.—Length, 10 mm. Black, the small joints of tarsi dark reddish. Clypeus, except lower margin and two spots, creamy white, shining, with sparse feeble punctures. Pubescence very pale ochreous white on vertex and mesothorax, but distinctly ochreous on pleura, cheeks, face, and metathorax. Head broad; process of labrum broad and low, truncate; sides of front dull and granular; cheeks normal, rather shining; antennae rather short for a male, flagellum obscure reddish brown beneath. Third antennal joint fully twice as long as fourth; fourth broader than long, fifth about as broad as long. Mesothorax dullish, well punctured; metathorax granular, the area defined by an impressed line. Tegulae dark in front, red behind. Wings hyaline, faintly brownish; stigma and nervures dark reddish. Basal nervure meeting transverse median; first recurrent nervure joining second submarginal beyond the beginning of its last third; third submarginal cell long, spurs dark. Abdomen shining, with only piliferous punctures, hoary with short pale hair, but no bands; hind margins of segments broadly reddish; second segment in middle depressed about one-third. Apical plate inversely heart shaped, strongly emarginate. (This is clearly a variety of *A. vestali* Cockerell, with pale hair and smoother abdomen.)

*b*²⁰. Clypeus yellow; basal nervure going a little basad of transverse median; flagellum red beneath.

*a*²¹. Flagellum short like that of a female.

ANDRENA BERKELEYI, new species.

Berkeley, Colorado. (Baker, 5833.)

Male.—Length, 9 mm. Black, small joints of tarsi dull ferruginous. Clypeus reddish white, doubtless very pale yellow in life, with two triangular black marks, each sending a linear process upward. Pubescence dull white, long on thorax above, scanty on abdomen, not forming bands. Head very broad; process of labrum broadly truncate, with a depression in middle above; malar space short; lower margin of clypeus arched, with projecting lateral angles, and dark colored, the light areas not extending either to the margin or to the sides below; clypeus distinctly, not very densely punctured, no

smooth median line; sides of front dull and depressed; vertex short; cheeks short, shining; antennae short, looking like those of a female, the flagellum bright ferruginous beneath except basally. Third antennal joint very much longer than fourth; fifth very short, much broader than long. Mesothorax moderately shining, with distinct but small and not crowded punctures. Scutellum strongly shining. Metathorax dull and granular, the triangular area merely defined by a depressed line. Tegulae dusky testaceous. Wings clear hyaline, nervures and stigma light reddish. Basal nervure going some distance basad of transverse median, first recurrent nervure joining second submarginal at middle; second transverse cubital wanting on one side. Abdomen shining, but well though not densely punctured; hind margins of segments rather broadly pallid; second segment in middle depressed hardly one-half. Apical plate broadened at end like an ax blade. End of sixth ventral segment turned up and projecting at sides.

Type.—Cat. No. 18136, U.S.N.M.

In the key, this falls close to *A. permitis*, but has brownish tarsi, those of *permitis* being stramineous. Its closest ally is a species still undescribed.

♂²¹. Flagellum very long.

ANDRENA CHEYENNORUM, new species.

War Bonnet Canyon, Sioux County, Nebraska. June 4, 1902. On *Symphoricarpus*. (M. Cary.)

Male.—Length, 9½ mm. Black, all the tarsi clear ferruginous. The very long flagellum chesnut red beneath except the first joint. Clypeus, except two triangular spots and lower edge, light yellow, but no lateral marks. Head rather oblong, facial quadrangle longer than broad. Malar space rather large. Mandibles not elongate, process of labrum emarginate. Clypeus, which is high, smooth, and sparsely punctured, with no median line. Cheeks ordinary. Third antennal joint longer than fourth, but fourth longer than broad. Hair of head and thorax very pale ochreous. Mesothorax rather shining, very feebly punctured. Area of metathorax dull and granular. Tegulae dark reddish. Wings reddish hyaline, faintly dusky at apex; stigma and nervures bright amber; basal nervure meeting transverse median; first recurrent nervure joining second submarginal before middle; third submarginal cell very long. Abdomen shining, hardly punctured, hind margins of segments brownish; second and following segments with rather distinct white hair bands, failing in middle on second and third. Apical plate very broad at end, truncate and ciliate.

Female.—(With same data as male.) Length, 11 mm. Pubescence more brightly colored, pale orange on hinder part of thorax above,

on hind tibiae and on tarsi, which are ferruginous. Hair on hind knees red. Head oblong, face narrower than in male, facial quadrangle much longer than broad, the wholly black clypeus convex, prominent, shining, with scattered punctures. Third antennal joint nearly twice as long as fourth; fifth no longer than fourth. Facial foveae seen from above pale yellowish, occupying less than half space between antenna and eye; below they narrow, ending a short distance from orbital margin a little below level of antennae. First abdominal segment without hair bands; second to fourth with dense and conspicuous creamy white bands, that on second narrowly interrupted in middle. Fifth segment and apex with light red hair, having a sort of apricot tint.

In the key, this falls in the group of *A. bradleyi*, from which it is separated thus:

Females:

Inclosure of metathorax appearing reticulate owing to the presence of crooked plicæ; caudal fimbria brown.....*bradleyi*.

Inclosure granular; fimbria golden.....*cheyennorum*.

Males:

Tarsi blackish.....*bradleyi*.

Tarsi stramineous.....*cheyennorum*.

The light tarsi also separate *cheyennorum* at once from *A. saccharina* Cockerell and Rohwer.

δ^{19} . Clypeus and lateral face-marks light.

α^{22} . Lateral face-marks large, filling space between clypeus and eye.

α^{23} . Flagellum dull red beneath; the small triangular area of metathorax conspicuous because bounded by pale hair.

ANDRENA MOQUIORUM, new species.

Flagstaff, Arizona. August, 1902. (Snow, No. 339.)

Male.—Length, 9 mm. Black, the legs and abdomen very dark rufofuscous; clypeus, a triangular supra-clypeal mark and large, nearly equilateral lateral areas cream color. Head very broad; mandibles long and slender, simple; malar space hardly developed; process of labrum narrow, rounded, prominent. Pubescence rather dull white, very faintly tinged with ochreous on thorax above. Clypeus feebly punctured; cheeks broad, angled below; flagellum dull pale reddish beneath. Third antennal joint about twice as long as fourth, and distinctly longer than fifth. Mesothorax dullish, with very minute inconspicuous punctures. Metathorax small, the triangular basal area defined only by absence of hair, its basal middle with slight rudimentary plicæ. Tegulae shining brown. Wings hyaline, dusky apically; the nervures and rather small stigma dark reddish. Basal nervure falling a considerable distance short of transverse median. Second submarginal cell large, receiving first recurrent nervure well beyond middle. Spurs pallid. Abdomen shining, feebly punctured; hind margins of segments with dense rather

narrow hair bands, that on second interrupted in middle, and that on first only present on sides; second segment depressed hardly one-third in middle. Apical plate broadly rounded at end.

In the key this falls in a couplet with *A. cressoni kansensis*, from which it is separated by the brownish hind tibiae (stramineous in *kansensis*).

b²³. Flagellum dark; area of metathorax not conspicuous as in *A. moquiorum*.

ANDRENA LATISIGNA, new species.

Placita, New Mexico. April 25, 1903. (T. D. A. and W. P. Cockerell.)

Male.—Length, 8½ mm. Black, the clypeus except two spots and broad lateral marks filling space between clypeus and eye except a small triangle just below each antennae, primrose yellow; tarsi and greater part of hind tibiae ferruginous. Pubescence pale ochreous. Head large and very broad. Process of labrum truncate. Antennae dark; third joint nearly as long as next two together; the fourth very short. Cheeks broad, hairy, dullish, not angled behind. Mesothorax and scutellum somewhat shiny, hardly punctured. Area of metathorax roughened. Tegulae brown with testaceous margins. Wings dusky hyaline, nervures and stigma clear ferruginous. Basal nervure meeting transverse median. First recurrent nervure received by second submarginal at or a little beyond middle. Abdomen with very small but distinct punctures on the first three segments; hind margins of second and following segments reddish, with rather inconspicuous grayish white hair bands, interrupted in middle of second. Second segment in middle depressed about one-third. Apical plate extremely narrow, slightly emarginate.

This is easily known from *A. bridwelli* by the large lateral face-marks, face-marks all light chrome yellow, and all tarsi red.

In the key it falls next to *A. miserabilis*.

b²². Lateral face-marks not filling space between clypeus and eye.

a²⁴. Abdomen blue; first recurrent nervure joining second submarginal cell before middle (not so in *bruneri* and *lawrencei*, which are not females of this group).

a²⁵. Hair of thorax above light ochreous.

ANDRENA LARAMIENSIS, new species.

Laramie, Wyoming. "6, 9, 93."

From collection of Prof. L. Bruner but collected by Professor Buffum.

Male.—Length about 10 mm. Head, thorax, and legs black, the small joints of tarsi dark reddish. Abdomen shining, dark greenish blue, apical margin of segments obscurely reddish. Clypeus except lower edge and two spots and rather large lateral marks not reaching

orbital margin, cream color. Hair of head and thorax long and shaggy, very pale ochereous; facial quadrangle broader than long; mandibles red at apex; process of labrum feebly emarginate. Antennae thick, flagellum obscurely reddish beneath. Third antennal joint about one-third longer than fourth, which is somewhat swollen; fifth a little longer than fourth. Clypeus and sides of face shining, with distinct and well separated punctures; sides of front rather shining, coarsely striate; vertex granular, narrow. Cheeks normal, very hairy. Mesothorax and scutellum shining, with small punctures; area of metathorax coarsely granular. Tegulae shining rufopiceous.

Wings hyaline, broadly dusky at apex; stigma and nervures amber color. Basal nervure falling short of transverse median. Second submarginal cell narrowed above, receiving first recurrent nervure about the end of its first third. Hair on inner side of tarsi bright orange. Abdomen shining, finely punctured; second segment in middle depressed much less than one-third. Dorsal surface of abdomen hoary with short thin pale hair which becomes longer and denser at sides, but does not form any distinct bands. Hairs at sides of abdomen beneath orange tinted. Apical plate very small and narrow.

*b*²⁶. Hair of thorax above white.

ANDRENA LARAMIENSIS, variety A.

War Bonnet Canyon, Sioux County, Nebraska. May 27, 1901. (M. A. Carriker.)

Male.—Length, 9 mm. Head black with the front dark blue. Thorax black, legs brown-black, the tarsi red at apex. Abdomen steel blue, the hind margins of the segments purplish red; clypeus, except two black spots and lower edge and subtriangular lateral marks not quite reaching eyes, light yellow. Head broad, eyes diverging above; process of labrum emarginate; mandibles red at apex; clypeus shining, rather sparsely punctured; front striate; cheeks normal, broad above. Third antennal joint not twice as long as fourth. Vertex, cheeks, thorax, and femora with much long dull white hair. Tibiae and tarsi with hair slightly ochereous. Mesothorax shining on disk and hardly punctured. Area of metathorax small, dull, and granular. Tegulae piceous. Wings hyaline, faintly brownish; nervures and the slender stigma amber color. Basal nervure falling short of transverse median. Second submarginal cell receiving first recurrent nervure near end of its first third. Third submarginal very broad above. Abdomen shining, with very fine punctures, covered with short white hair not hiding the surface, denser at sides but not forming distinct bands. Apical plate emarginate.

Related to *A. laramiensis*, with which it agrees in the tegumentary colors and the venation. The lateral face marks do not project

above so much as in *A. laramiensis*, and the hair of the thorax is much paler. (After close study, I can only consider this a variation of *laramiensis*. In the key it is separated on the proportions of the antennal joints.)

*b*²⁴. Abdomen black; first recurrent nervure joins second submarginal cell before middle.

ANDRENA TETONORUM, new species.

Sioux County, Nebraska. May. (L. Bruner.)

Male.—Length, 9 mm. Black, small joints of the tarsi reddish, clypeus except lower edge and two black spots and narrow lanceolate lateral marks close to sides of clypeus but only touching at lower end, creamy white. Head broad; process of labrum emarginate; clypeus shining, with strong but not dense punctures; front and vertex dull; cheeks normal; flagellum obscurely brownish beneath except at base. Third antennal joint about twice as long as fourth; fifth only about as long as fourth. Head and thorax with abundant long creamy white hair. Mesothorax dull, with small punctures; scutellum shining anteriorly; area of metathorax granular, defined by absence of hair. Tegulae dark red-brown. Wings reddish hyaline, stigma and nervures amber color, the nervures on basal part of the wing becoming fuscous; stigma rather small. Basal nervure meeting transverse median. First recurrent nervure joining second submarginal cell before middle. Third submarginal rather short. Spurs cream color. Abdomen shining, without evident punctures; hind margins of the segments with thin white hair bands, that on first very feeble. Hair on under side of apical half of abdomen yellowish.

(The form next described is in my opinion conspecific with *A. tetonorum*, though it is smaller, and is separated in the key on the proportions of the antennal joints.) *A. tetonorum* falls in the key close to *A. cressoni kansensis*, from which it is separated by the indistinctly punctured abdomen.

ANDRENA TETONORUM, variety A.

Sioux County, Nebraska. (L. Bruner.)

Male.—Length, 8½ mm. The rather short antennae and dense orange hair at apex of abdomen make it look like a female. Black, the small joints of tarsi ferruginous. Clypeus, except two spots on lower edge and very small elongate lateral marks close to sides of clypeus, cream color. Pubescence light ochreous. Head ordinary, facial quadrangle broader than long. Process of labrum emarginate. Clypeus sparsely and feebly punctured, more strongly at sides. Flagellum very dark reddish beneath. Third antennal joint long, fully as long as the next two joints together, but the fifth is quite short. Mesothorax dull, feebly punctured; scutellum shining in front; area of metathorax dull and granular. Tegulae piceous with pallid mar-

gins. Wings reddish hyaline, nervures and stigma clear amber. Basal nervure just short of transverse median. Second submarginal cell receiving first recurrent nervure before middle. Third submarginal short. Spurs ferruginous. Abdomen shining, with only weak piliferous punctures. Hind margins of segments with creamy white hair bands. Second segment in middle depressed less than one-third. Abdominal segments beneath fringed with ferruginous hair. Apical plate truncate.

A. lappulae is very close to this, but has the head broader and shorter, pubescence paler (not pale orange or fulvous on abdomen beneath, as it is in *tetonorum*), lateral face-marks larger, stigma distinctly margined.

b¹⁸. No light face-markings (except in *A. colletoides*).

a²⁶. Large robust species, 15 mm. long or over.

a²⁷. Pleura and cheeks with black hair; wings dark.

ANDRENA CARLINIFORMIS, new species.

"Sierra Madre, 8,000 [feet] altitude. California." (Collector and history unknown.)

Female.—Length, 16 mm. Black, the small joints of the tarsi more or less reddish, the flagellum hardly noticeably brownish. Pubescence black, except on thorax above, tubercles and middle of metathorax, where it is yellowish white. Facial quadrangle broader than long. Process of labrum narrowly truncate, conspicuously thickened at end. Clypeus shining, strongly and closely punctured, with a smooth median ridge. Facial foveae seen from above very dark gray, very broad, ending broadly below at about level of top of clypeus. Third antennal joint shorter than next three combined. Mesothorax and scutellum so densely covered with hair that the surface can not be seen, but it is not shining. Area of metathorax dull, feebly transversely wrinkled. Tegulae piceous. Wings dark fuliginous, slightly violaceous. Nervures and the very small stigma piceous. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure a little beyond middle. Third submarginal greatly narrowed above. Legs with black hair. Hind femora with the tegument red beneath. Abdomen shining, without distinct punctures, and with no hair bands.

This is very like *A. perimelas*, but considerably more slender; stigma smaller and darker (red in *perimelas*), third transverse cubital with a double curve (upper end straight in *perimelas*), tubercles and middle of metathorax with light hair.

b²⁷. Pleura and cheeks with reddish or fulvous hair.

a²⁸. Abdomen distinctly punctured; hair of hind tibiae very pale fulvous.

ANDRENA HELIANTHIFORMIS, new species.

Montana.

Female.—Length, 15 mm. Black; small joints of tarsi reddish. Pubescence ochreous, short, brightly colored, and quite dense on thorax above. Upper side of abdomen with thin short erect white hair, but not hiding surface. Facial quadrangle a little broader than long. Process of labrum very broadly truncate, faintly emarginate. Clypeus shining, with sparse distinct punctures and a faint median ridge, its lower margin overlapped by long brownish hairs. Facial foveae seen from above cream color, occupying about half space between eye and antennae; they do not extend below level of antennae. Flagellum beneath ferruginous except at base, and above the apical margins of the joints are red. Third antennal joint as long as next three together. Mesothorax dull, finely punctured, surface almost hidden by hair. Area of metathorax granular. Metathorax distinctly truncate posteriorly. Tegulae ferruginous. Wings dark red brown; nervures fuscous, the small slender stigma darker. Basal nervure meeting transverse median. Transverse median strongly bent near lower end. Second submarginal cell extremely broad, receiving first recurrent nervure beyond middle. Hair on hind tibiae loose, ochreous; abdomen dull, with small, numerous punctures, hair bands very thin; hair at apex light brownish ferruginous; second segment in middle depressed about one-third.

Type.—Collection of the American Entomological Society.

Resembles *A. haynesi*, but readily distinguished by the shining clypeus, light tegulae, and distinctly punctured abdomen. Compared with *A. helianthiformis*, *A. sayi* has a much more shiny abdomen and much broader facial foveae.

*b*²⁸. Abdomen minutely indistinctly punctured; hair of hind tibiae dark brown.

ANDRENA HAYNESI, new species.

War Bonnet Canyon, Nebraska. June 24, 1901. On *Helianthus*. (J. C. Crawford.)

Female.—Length, 16 mm. Robust, black. Head and thorax with rather short dense fulvous hair. Hair of middle and hind tibiae and tarsi brownish black, that of hind femora of the same color except at base, otherwise hair of legs fulvous. Facial quadrangle broader than long; malar space distinct; process of labrum emarginate, the labrum below the process densely fringed with red hair. Clypeus with rather close small punctures. Facial foveae seen from above light reddish, occupying fully two-thirds space between eye and antenna; below they end close to eye, a little below level of antennae. Flagellum with the apical part bright red beneath. Third antennal joint as long as the

following three together. Mesothorax dull, almost entirely concealed by hair. Area of metathorax small, irregularly, transversely, wrinkled, the margins smooth but not shining. Tegulae piceous. Wings strongly brownish, the broad apical margins darker. Stigma slender and small, blackish, but a bright red spot at its base; nervures dusky ferruginous, some lighter than others. Basal nervure meeting transverse median. Second submarginal cell very broad, its lower inner corner produced, the first recurrent nervure joining it before the middle. Abdomen broad and flattish, not punctured; first segment with hind margin red; sides of segments with short reddish hair forming interrupted band on third and complete one on fourth; hair at apex dense, reddish brown.

Distinguished from *A. pecosana* by the darker pubescence and much larger size.

Type.—Cat. No. 18139, U.S.N.M.

*b*²⁶. Less than 15 mm. long.

*a*²⁹. Males.

*a*³⁰. Abdomen dull, with dense entire hair bands; legs red; clypeus and lateral face marks yellow.

ANDRENA COLLETOIDES, new species.

Colorado. (Snow, 1030.)

Male.—Length, 10 mm. Black; legs ferruginous, blackish at base; clypeus except lower edge, and small lateral face marks receding from eye and following sides of eye, yellow. Pubescence grayish white, very abundant on head and thorax and first abdominal segment, remaining abdominal segments thinly covered with pubescence, and all with thick, shaggy apical hair bands.

Head ordinary; facial quadrangle about square, somewhat broadened above. Process of labrum emarginate. Clypeus shining, with distinct scattered punctures. Vertex moderately shining. Cheeks normal, very hairy. Flagellum red, brighter beneath, blackened at base. Third antennal joint nearly twice as long as fourth and longer than fifth. Mesothorax dullish, very feebly punctured; the small long-triangular area of metathorax dull and granular, only defined by absence of hair; tegulae warm reddish testaceous. Wings clear hyaline, the small narrow stigma and the nervures testaceous. Basal nervure falling a trifle short of transverse median. Second submarginal cell very large, receiving first recurrent nervure beyond middle. Abdomen dull, not evidently punctured. Apical plate narrow, emarginate.

In the key this is separated from *A. vernoni* by the whitish pubescence.

The male of *A. costillensis* resembles this as to bands, but the clypeus is black, and the legs are not red.

*b*³⁰. Abdomen with weak bands or none.

*a*³¹. At least the hind tarsi ferruginous (light brown in *navajorum*).

*a*³². Abdomen without hair-bands; flagellum bright red beneath; cheeks very broad.

ANDRENA SUBAUSTRALIFORMIS, new species.

Colorado. No. 2112. (Gillette.)

Male.—Length, about 9 mm. Black; the tarsi bright ferruginous and the flagellum except the first joint bright ferruginous beneath. Pubescence pale ochreous, long on head and thorax. Head large and broad, facial quadrangle much broader than long. Mandibles long, curved downward, red at tip; process of labrum emarginate; clypeus very finely punctured, almost hidden by long hair; sides of front dull, finely striate; cheeks shining, very broad, obtusely angled behind a little above the middle, but neither toothed nor with a sharp marginal keel. Third antennal joint not much longer than fourth, and only a trifle longer than fifth. Tegulae reddish; wings hyaline, tinged with red, a little dusky apically, stigma and nervures clear amber. Basal nervure meeting transverse median or falling a little short of it. Second submarginal cell receiving first recurrent nervure in middle. Sculpture of thorax essentially as in *A. moesticolor*. Spurs ferruginous. Abdomen shining, without evident punctures, hind margins of segments obscurely reddish in some lights. Second segment in middle depressed less than one-third. A fine soft pubescence all over segments but no hair bands. Apical plate narrow.

This is easily distinguished from *A. occidentialis* by the structure of the cheeks.

Type.—Cat. No. 18140, U.S.N.M.

*b*³². Abdomen with evident hair bands.

*a*³³. Flagellum bright ferruginous beneath; cheeks angled behind.

ANDRENA CANADENSIS OSLARELLA, new subspecies.

Denver, Colorado. 5562. (Oslar.)

Male.—Length, 8 mm. Black, with ferruginous tarsi and the flagellum light ferruginous beneath except at base. Pubescence grayish white, not at all yellowish. Head very broad. Process of labrum emarginate. Clypeus shining, with numerous minute punctures; no smooth line or ridge. Third antennal joint a little shorter than the next two combined. Cheeks broad, shining, angled behind, the angle about level with middle of eye. Mesothorax and scutellum shining, not evidently punctured. Area of metathorax dull and granular. Tegulae rufotestaceous. Wings clear hyaline, slightly milky; stigma and nervures ferruginous; stigma dusky margined. Basal nervure falling a little short of transverse median. Second submarginal cell receiving first recurrent nervure a little beyond middle or practically

at middle. Spurs white. Abdomen shining, without evident punctures. Hind margins of second and following segments with thin but entire white hair bands. Apical plate truncate.

Type.—Cat. No. 18141, U.S.N.M.

The cheeks and top of head are quite different from those of *A. occidentalis*.

In the key this falls in a couplet with *canadensis*, and is distinguished by the "hind metatarsi yellowish stramineous."

δ^{33} . Flagellum dark.

α^{34} . Head very large, with broad shining cheeks, which have a sharp rim behind; legs reddish brown.

ANDRENA NAVAJORUM, new species.

Albuquerque, New Mexico. (Osler.)

Male.—Length, 8 mm.

Very close to *A. occidentalis* variety *A*, but smaller. Clypeus without well defined median depression. Cheeks not angled behind but with same sharp raised border. The tarsi and hind tibiae rather light brown.

Type.—Cat. No. 18142, U.S.N.M.

δ^{34} . Head ordinary.

ANDRENA AGRICOLARUM, new species.

Fort Collins, Colorado. May 12, 1903. (Colorado Agricultural College.)

Male.—Length, nearly 8 mm. Black, with dull white hair, pale ochereous on thorax above. Head broad, but otherwise ordinary. Facial quadrangle considerably broader than long. Mandibles short. Process of labrum small and narrow. Clypeus shining, rather sparsely punctured. Vertex dull and depressed on each side of ocelli, but a shining ridge between vertex and cheeks. Antennae slender, flagellum dark reddish beneath. Third antennal joint little longer than fourth, but not nearly as long as fourth and fifth combined. Mesothorax slightly shining, feebly punctured. Area of metathorax dull and granular. Tegulae rufopiceous. Wings hyaline, faintly reddish, slightly dusky at apex. Stigma and nervures clear amber color, the outer nervures more or less fuscous. Basal nervure meeting transverse median. Second submarginal cell narrow, receiving first recurrent nervure a little beyond middle. All the tarsi clear ferruginous. Abdomen black, not at all metallic, not evidently punctured, the segments dark reddish apically; third and following segments and second at sides with white hair bands; second segment in middle depressed hardly a third. Apical plate very small and narrow, truncate, surrounded by hair, but without long fringe extending beyond.

In the key this falls next to *A. viburnella*, which is considered a subspecies of *A. perplexa*.

Type.—Cat. No. 18165, U.S.N.M.

*b*³¹. Tarsi dark.

*a*³⁵. Large species, anterior wing 10 mm. long; with fulvous or ferruginous hair. (See *A. jockorum*, under *Trachandrena*, above.)

*b*³⁵. Small, or if approaching size of *A. jockorum*, hair not red. None have flagellum brightly colored beneath.

*a*³⁶. Sides of front with black hair. (If hair of face all black, see *A. nigrihirta* and *A. micranthophila*.)

*a*³⁷. Hair of thorax above ferruginous.

*a*³⁸. Larger; cheeks very broad, shining, angled behind; head very large.

ANDRENA HEMILEUCA Viereck.

East of Lake George, Colorado. June 18. (S. A. Rohwer.)

Male.—Length, about 10½ mm. Black, the tarsi reddish apically, the hind tarsi entirely dark reddish. Pubescence pale fulvous, black at sides of face and top of cheeks. Head large and broad; facial quadrangle much broader than long. Process of labrum deeply emarginate. Mandibles long, curved downward, red at end. Clypeus brilliantly shining, sparsely punctured. Antennae black; third joint little longer than fourth and about equal to fifth. Cheeks very broad, smooth and shining, produced nearly to a right angle behind. Mesothorax hardly punctured, dull in front, shining behind. Scutellum shining. Area of metathorax dull and granular. Tegulae rather light reddish. Wings hyaline, faintly dusky; stigma and nervures ferruginous; stigma very bright; outer nervures becoming fuscous. Basal nervure falling just short of transverse median. Second submarginal cell very broad, receiving first recurrent nervure very near its end. Abdomen shining, not punctured, with thin reddish hair forming very thin inconspicuous bands; second segment in middle depressed hardly one-fourth. Apical plate narrow, not emarginate.

(This is determined as *A. hemileuca* by Viereck; the original *hemileuca* came from Washington and Oregon, and was based on the female, which is 10 mm. long. Female *A. hemileuca* is shown in the key to have the following characters: Most dorsal abdominal segments impunctate or indistinctly punctured; second dorsal segment with more or less abundant erect or nearly erect hair; hair of scopa pale; dorsal segments with dark hairs; posterior tibiae blackish; pubescence of face concolorous, all black; clypeus coarsely punctured. Male *A. hemileuca* is shown in the key to have the facial tegument all dark; third antennal joint shorter than fourth; cheeks angled, the angle opposite middle of eye. The male falls in a couplet with *A. integra*.)

*b*³⁸. Smaller; cheeks dullish, not very broad.

ANDRENA WASHINGTONI MANITUENSIS, new subspecies.

Manitou, Colorado. April 28. At flowers of *Ribes leptanthum*. (T. D. A. and W. P. Cockerell.)

Male.—Length slightly over 8 mm. Black, with pale reddish hair, that on thorax above quite bright. Sides of face and anterior part of cheeks above with black hair. Head broad but otherwise ordinary; facial quadrangle very much broader than long. Process of labrum emarginate. Clypeus shining, rather well punctured; front dull. Head behind and above eyes broad and flattened. Antennae long but rather thick, entirely black; third joint little longer than fourth and about equal to fifth. Mesothorax dull, not evidently punctured; area of metathorax granular. Spurs cream color. Tegulae dark reddish. Wings hyaline, faintly dusky, nervures and the large stigma dull amber. Basal nervure falling short of transverse median. Second submarginal cell small, receiving first recurrent nervure in middle. Abdomen rather slender, shining, without evident punctures, with very thin inconspicuous pale reddish hair bands, absent on first segment and broadly interrupted in middle of next three. Second segment in middle depressed about one-third. Apical plate small, not emarginate, almost hidden in light reddish hair.

In the key this is separated from *A. washingtoni* by the nonfasciate abdomen.

δ^{37} . Hair of thorax above ochreous or white.

α^{39} . Second submarginal cell receiving first recurrent nervure far beyond middle.

α^{40} . Pubescence white; cheeks very broad, tuberculate-angled behind above level of middle of eye; scutellum dullish anteriorly.

ANDRENA MOESTICOLOR, new species.

South Park, Colorado. July 23, 1898.

Male.—Length, 9 mm. Black. The tarsi ferruginous apically, the basitarsi also more or less reddish. Pubescence long and white; black at sides of face above. Head very large and broad. Mandibles long and curved downwards, red at apex. Process of labrum slightly emarginate. Clypeus rather closely punctured, with a narrow median smooth hue. Sides of front and vertex dull and finely striate. Cheeks extremely broad, shining, toothed behind a little above the middle. Flagellum obscure brownish beneath. Third antennal joint about a third longer than fourth, fifth a little longer than fourth. Mesothorax dull and granular, the posterior middle moderately shining; area of metathorax short, dull and granular. Tegulae ferruginous, clouded with darker; wings hyaline, very faintly reddish; nervures and stigma dark reddish. Basal nervure just falling short of transverse median. Second submarginal cell large and square, receiving first recurrent nervure about the beginning of its last third. Spurs cream color. Abdomen rather narrow, brilliantly

shining, without evident punctures; hind margin of first segment narrowly and the following ones broadly dark red; second segment in middle depressed more than one third. No hair bands. Apical plate large, emarginate.

Type.—Cat. No. 18143, U.S.N.M.

In the key this falls near *A. mentzeliae*, from which it is separated by its smaller size. Recently (June 25, 1913) both sexes have been found at Longs Peak Inn, Colorado, visiting flowers of *Potentilla* (T. D. A. and W. P. Cockerell). The female is remarkable for the short hair on the hind tibia. It resembles *A. birtwelli* in appearance.

♂⁴⁰. Pubescence ochreous; cheeks not angled-tuberculate behind in the type, but this character seems variable; scutellum brilliantly shining anteriorly.

ANDRENA RIBIFLORIS, new species.

Florissant, Colorado. (S. A. Rohwer.) At flowers of *Ribes vallicola*. June 19, 1907.

Male.—9 mm. long, slender. Black, with pale pubescence, which is distinctly ochreous on thorax above, more or less fuscous on scape and at sides of face. Head broad, eyes approximately parallel. Facial quadrangle much broader than long. Process of labrum broad, truncate. Mandibles red at apex. Malar space rather large. Clypeus shining, with sparse small punctures. Front minutely striate; cheeks broad, shining, with a distinct angle between cheeks and occiput. Antennae long, flagellum brown beneath. Third antennal joint hardly longer than fourth and not as long as fifth. Mesothorax minutely granular, dullish except posteriorly; scutellum brilliantly shining; area of metathorax dull and granular. Tegulae reddish brown. Wings hyaline, faintly brownish apically; stigma and nervures dark amber color. Basal nervure falling a considerable distance short of transverse median. Second submarginal cell broad, receiving first recurrent nervure near beginning of its last third. Third submarginal long. Tarsi reddish. Abdomen shining, without evident punctures, and with scanty short hair not forming distinct bands. Hind margins of segments dark reddish. Second segment in middle depressed hardly one-fourth. Hair about apex of abdomen with golden tints. Apical plate very small and narrow, truncate.

Readily distinguished from *A. polygoni* by the colors, the venation and the broad head.

Type.—Cat. No. 18144, U.S.N.M.

In the key, this falls in a couplet with *A. distans*, and is separated as follows:

Clypeus dull, vertex without blackish hairs.....*distans*.
Clypeus shining, vertex with some blackish hairs.....*ribifloris*.

(When I examined seven males collected by Mr. S. A. Rohwer at Florissant, June 12-19, six at *Ribes vallicola*, one at *Ribes longiflorum*,

I could not distinctly separate two species, though some were considered to be *ribifloris*, and one was determined as *hemileuca* by Mr. Viereck. In the present paper I give characters to separate the described specimens of *hemileuca* and *ribifloris*, but the matter needs further investigation. In the key, they separate on the character of the antennae, *hemileuca* having the third joint shorter than the fourth, which is not true of *ribifloris*.)

*b*³⁹. Second submarginal cell receiving first recurrent nervure at or near middle.

*a*⁴¹. Cheeks strongly angled behind; abdomen not evidently banded.

ANDRENA ENIGMATICA, new species.

Lincoln, Nebraska. April 25, 1901. On willow. (M. A. Carriker.)

Male.—Length, $8\frac{1}{2}$ mm. Black, slender, with long pale hair distinctly tinged with ochreous on scutellum; some fuscous hairs at sides of front. Head large and broad, facial quadrangle very much broader than long. Mandibles long and slender, curved downward, red at apex; process of labrum truncate; clypeus moderately shining, with rather shallow punctures; sides of front dull and finely striate. Antennae long and slender, flagellum obscure brown beneath. Third antennal joint not quite twice as long as fourth; fourth longer than broad; fifth conspicuously longer than fourth. Cheeks shining, very broad, triangular, produced to a right angle behind. Mesothorax dull and granular. Scutellum shining in front. Metathorax granular, the area very small. Wings hyaline, dusky at apex, stigma and nervures dull amber. Basal nervure falling short of transverse median. Second submarginal cell broad, receiving first recurrent nervure beyond middle. Hind legs long and slender. Abdomen narrow, shining, impunctate, with scattered pale hair not forming well-defined bands. Hind margins of segments obscurely reddish. Second segment in middle depressed less than a third. Apical plate rather broad, not emarginate.

Type.—Entomological collection of the University of Nebraska.

In the key, this falls close to *A. moesta albihirta*, from which it is known by the absence of black hair on the cheeks.

*b*⁴¹. Cheeks not angled behind; abdomen subfasciate.

*a*⁴². Fourth antennal joint conspicuously longer than broad; hair of face creamy white; basal nervure falling short of transverse median.

ANDRENA CANDIDIFORMIS, new species.

Colorado. (Gillette, No. 2112.)

Male.—Length, 7 mm. Black; small joints of tarsi ferruginous; hair grayish white, pale ochreous on thorax above, black at sides of front. Head broad but otherwise ordinary. Facial quadrangle much longer than broad. Process of labrum broad, truncate; man-

dibles not elongate; clypeus moderately shining, with weak punctures; front dull. Antennae long and slender, flagellum dark brown beneath. Third antennal joint shorter than fourth; fifth about as long as fourth. Mesothorax dull, scutellum shining in front. Area of metathorax granular, rather large. Tegulae dark brown; wings reddish hyaline; nervures and the large stigma rather dark amber. Basal nervure falling short of transverse median. Second submarginal cell receiving first recurrent nervure in middle. Third submarginal short. Hair on inner side of hind tarsi creamy white. Abdomen shining, without evident punctures, thinly hairy, with indications of bands at sides of segments; hind margins of segments dark reddish. Second segment in middle depressed not quite one-third. Apical plate emarginate.

Type.—Cat. No. 18146, U.S.N.M.

The following is taken from the key:

- | | |
|--|-------------------------|
| Pubescence of head mostly black; abdomen bluish..... | 1 |
| Pubescence of head not mostly black..... | 3 |
| 1. Abdomen seemingly impunctate..... | 2 |
| Abdomen distinctly punctate..... | <i>mimetica</i> . |
| 2. Hardly any pale hair on face..... | <i>candida</i> . |
| Considerable pale hair on face..... | <i>nigrocaerulea</i> . |
| 3. Pubescence of head partly black..... | 4 |
| Pubescence of head all pale..... | <i>trizonata</i> , etc. |
| 4. Antennae black or blackish; abdomen bluish to greenish..... | <i>cerasifolii</i> . |
| Antennae partly pale..... | <i>candidiformis</i> . |

*b*⁴². Fourth antennal joint not longer than broad; hair of face ochreous; basal nervure meeting transverse median, or falling a little short of it.

ANDRENA FERNALDIELLA, new species.

Florissant, Colorado. June 2, 1907. At flowers of *Salix brachycarpa*. (S. A. Rohwer.)

Male.—Length, 7½ mm. Black, with pale ochreous hair. Head very broad. Process of labrum broadly truncate. Clypeus shining, finely punctured, covered with long hair. Front dull and flattened. Cheeks broad but not angled. Antennae very long; flagellum obscure brown beneath. Third antennal joint a little longer than fourth, but hardly as long as fifth. Mesothorax and scutellum dull and granular. Area of metathorax with very feeble ridges, producing a sort of rugosity. Tegulae rufopiceous. Wings hyaline, nervures and stigma amber color. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure beyond middle. Tarsi entirely dark. Abdomen shining, not punctured; hind margins of segments somewhat reddish; second segment in middle depressed scarcely one-third; second and following segments with loose weak hair bands. Apical plate truncate.

(*A. fernaldiella* and *candidiformis* are practically the same except as to the fourth antennal joint. By the antennal characters the male

of *A. atala* falls with *fernaldiella*, and is found on comparison to be nearly the same, but the color of the pubescence is different, and the stigma is much darker. I think they are distinct species. *A. fernaldiella* occurs at *Salix*, but *A. atala* at *Polemonium*.)

δ^{36} . Sides of front without black hair.

α^{43} . Comparatively large species, with large heads.

α^{44} . Cheeks in lateral outline gently rounded, their surface granular.

ANDRENA INTERROGATIONIS, new species.

Colorado. (C. F. Baker, No. 1858.)

Male.—Length, $10\frac{1}{2}$ mm. Black, the tarsi red at apex. Hair grayish white, slightly yellowish on thorax above, a little black at sides of front. Head very large and broad, but the swollen cheeks are neither angled nor sharply margined behind, their surface is dullish except just behind the eyes. Facial quadrangle very much broader than long. Mandibles long but moderately stout. Labrum shining, triangular, without an evident process. Clypeus granular, sides of face dull with sparse weak punctures, the punctures stronger below. Long dark hairs at extreme sides of face. Antennae slender, flagellum dark brownish beneath. Third antennal joint relatively short and broad, hardly longer than fourth and distinctly shorter than fifth. Mesothorax dull, feebly punctured. Scutellum shining in front. Area of metathorax slightly irregularly wrinkled at base. Tegulae piceous. Wings brownish hyaline, nervures and stigma ferruginous. Basal nervure falling just short of transverse median. Second submarginal cell large, receiving first recurrent nervure well beyond middle. Third submarginal very broad above. Spurs pallid. Abdomen broad, moderately shining, with minute feeble punctures; the segments pruinose with short pale hair, but without bands; second segment in middle depressed about one-third. Apical plate large, rounded, but with parallel sides.

Type.—Cat. No. 18147, U.S.N.M.

In the key this falls near *A. micranthophila*, differing by the mostly pale hair of head.

δ^{44} . Cheeks in lateral outline angled, and concave just below the angle.

ANDRENA OCCIDENTALIS (Cockerell), variety *A*.

Sapello Canyon, New Mexico. July 28, 1902. (Oslar.)

Male.—Length, 9 mm. Black, small joints of tarsi reddish. Pubescence ochreous, only moderately dense, but long on head and thorax. Head very large and broad, the eyes converging above, facial quadrangle very much longer than broad. Vertex seen from in front elevated, straight, showing in profile an angle above each eye; cheeks swollen, smooth and shining, extremely broad, obtusely angled behind near middle and with posterior edge bounded by a

sharp and prominent keel; mandibles long and slender, dark red apically and with a small inner tooth. Process of labrum broad and rounded. Clypeus very wide, with a broad median smooth very sparsely punctured microscopically tessellate area, sides with small and rather numerous punctures. Front dull, coarsely vertically striate; sides of vertex smooth and shiny. Flagellum obscurely brownish beneath, first joint dull, contrasting with the remaining joints, which are shining. Third antennal joint not twice as long as fourth; fifth not much longer than fourth. Mesothorax dull in front, but posteriorly shining, with scattered extremely minute punctures; scutellum shining; area of metathorax rather shining, without ridges, but with a median impressed line. Wings strongly brownish, stigma and nervures dark red brown, stigma narrow. Basal nervure falling just short of transverse median. Second submarginal cell large, receiving first recurrent nervure beyond the beginning on its last third. Hind legs long and slender. Abdomen broad and convex, shiny, not evidently punctured, hind margins of segments very obscurely brownish. Pubescence scanty, but forming thin bands at sides of first three segments and entire ones on fourth and fifth.

Apical plate broadly truncate.

(This has the exact structure of *occidentalis*, but the type of that species is smaller, with dull ferruginous hind tarsi, and clear ferruginous tegulae. However, an *occidentalis* from Beulah, Sapello Canyon, New Mexico, no larger than the type, has dark reddish-brown tegulae and hind tarsi dull brown.)

c⁴⁴. Cheeks in lateral outline obtusely angled, without a distinct convexity below the angle; cheeks very broad.

ANDRENA DURANGOENSIS, new species.

Durango, Colorado. May 19, 1899. (Oslar.)

Male.—Length, 10½ mm. Black, with long grayish white hair, a little black at sides of front above, but this is very inconspicuous and easily overlooked. Head extremely large and broad, facial quadrangle much longer than broad; process of labrum emarginate; mandibles long and slender, curved downward; clypeus shining, sparsely punctured, flattened in middle; sides of front dull, but vertex shining; malar space rather large. Antennae slender, flagellum obscure brown beneath. Third antennal joint not greatly longer than fourth; fourth much longer than wide; fifth a little longer than fourth. Cheeks extremely large, shining, convex, obtusely rectangular behind. Mesothorax small, dull and granular, as also scutellum, postscutellum and metathorax, but sides of prothorax smooth and brilliantly shining. Tegulae dark brown. Wings brownish hyaline, apical margin darker. Stigma and nervures dark reddish. Basal nervure falling short of transverse median, the large second sub-

marginal cell receiving first recurrent nervure not far from its end. Spurs dark. Hair on inner side of hind tarsi chocolate. Abdomen shining, without distinct punctures; hind margins of segments obscurely brownish; second segment in middle depressed about one-third; first segment with long white hair, the others with little hair and no bands. Apical plate small and narrow.

Type.—Cat. No. 18148, U.S.N.M.

In the key this falls near *A. moesticolor*.

*b*⁴³. Smaller, more ordinary species.

*a*⁴⁵. First recurrent nervure joins second submarginal cell far beyond middle; hair of thorax pale ochreous or fulvous.

*a*⁴⁶. Head extremely broad.

ANDRENA LAMINIBUCCA, new species.

Topaz Butte, Colorado. June 17. (S. A. Rohwer.)

Male.—Length, 10½ mm. Black, small joints of tarsi reddish. Pubescence pale fulvous, bright on scutellum. Head very broad, malar space rather large. Process of labrum strongly emarginate. Mandibles with a projecting angle at base beneath. Clypeus shining, indistinctly punctured, with a flattened median ridge. Antennae very long; third joint only a little longer than fourth. Flagellum dark reddish beneath. Cheeks very broad, flattened, angled behind at about level of middle of eye. Thorax with long hair. Mesothorax, scutellum and area of metathorax dull and granular. Tegulae dark reddish. Wings reddish hyaline, nervures and stigma ferruginous. Basal nervure falling just short of transverse median. Second submarginal cell receiving first recurrent nervure near its end. Third submarginal very broad above. Abdomen shining, without evident punctures; hind margins of segments dark reddish, no distinct hair bands. Apical plate rounded.

Easily known from *A. tacitula grossulariae*, another red-haired species found at Topaz Butte, by the smooth, impunctate abdomen.

*b*⁴⁶. Head ordinary. (See *A. profundiformis* in *Trachandrena*, above.)

*b*⁴⁵. First recurrent nervure joins second submarginal at or not far beyond middle.

*a*⁴⁷. Pubescence ferruginous.

(See *A. tacitula grossulariae* in *Trachandrena*, above.)

*b*⁴⁷. Pubescence not ferruginous.

*a*⁴⁸. Head very broad.

*a*⁴⁹. Eyes diverging below; cheeks shining, broad, with a rim behind.

(See *A. navajorum*, above.)

*b*⁴⁹. Eyes not diverging below.

ANDRENA, species.

Sioux County, Nebraska. May. (L. Bruner.)

Male.—Length, 7 mm.; pubescence clear white; wings clear hyaline; basal nervure going far basal of transverse median; second submarginal receiving first recurrent nervure in middle.

(This was marked as the male of *A. trapezoidina*, described below; but in my opinion it is a quite distinct species.)

*b*⁴⁸. Head ordinary.

*a*⁵⁰. Face broader.

ANDRENA PADOUCORUM, new species.

Evergreen, Colorado. July 16, 1897. On *Sedum stenopetalum*. (Dunning, 1308.)

Male.—Length, 8 mm. Black, with dull white pubescence. Head broad, facial quadrangle broader than long. Process of labrum broad, truncate. Clypeus convex, shining, with strong well separated punctures. Front and vertex dull. Cheeks normal. Flagellum obscurely brownish beneath. Third antennal joint more than twice as long as fourth, and about one-third longer than fifth. Mesothorax dull, without evident punctures. Metathorax dull and granular, the area scarcely defined. Tegulae dark brown. Wings hyaline, the stigma and nervures dark reddish brown. Basal nervure meeting transverse median. First recurrent nervure joining second submarginal cell about middle. Spurs light ferruginous. Abdomen shining, thinly hairy, the hind margin of the segments brownish, and with thin white hair bands at sides of segments and right across on fourth. Apical plate small and narrow.

(This is very close to *A. campanulae*; possibly only a variety or race.)

In the key, *A. padoucorum* falls in a couplet with *A. harveyi*, separating thus:

Cheeks rectangular in outline, angle of cheeks opposite middle of eye; pubescence on face and thorax partly black.....	<i>harveyi</i>
Cheeks rounded in outline; pubescence whitish.....	<i>padoucorum</i>

ANDRENA CAMPANULAE, new species.

Palmer Lake, Colorado. July 13, 1901.

Male.—Length, about 8 mm. Black; pubescence grayish white, not so long as in some other species. Head ordinary. Facial quadrangle about square. Mandibles not especially long, red at tip. Process of labrum broadly truncate. Clypeus shining, with strong, well-separated punctures; front dull. Flagellum obscure reddish beneath. Third antennal joint twice as long as fourth; fifth longer than fourth but still short. Mesothorax dull even posteriorly, scutellum also dull; area of metathorax small, coarsely granular, obscurely plicate at base. Tegulae piceous. Wings brownish, the basal half clear hyaline, nervures and stigma dark reddish. Basal nervure meeting transverse median. First recurrent nervure joining second submarginal cell beyond middle. Spurs amber color. Hair on inner side of hind tarsi light chocolate. Abdomen shining, hardly punctured, hind margins of segments somewhat reddish; second segment

in middle depressed more than one-third; thin shaggy hair bands more or less failing in middle. Apical plate narrow, *not* emarginate.

(For the female, see below.)

Type.—Cat. No. 18149, U.S.N.M.

Male *A. campanulae* was also taken in Nebraska.

*b*²⁹. Females.

*a*⁵¹. Abdomen with long, loose hair, not forming bands; hair of cheeks black.

*a*⁵². Hair of thorax and abdomen above cream color.

ANDRENA PYRRHACITA COLORADENSIS, new variety.

Berkeley, Colorado. 5837.

Female.—Length, 11 mm. Black, with long creamy white hair covering thorax and abdomen above, and also on vertex and between antennae, and on the upper part of the pleura, but hair of other parts of head and underside of thorax black. Anterior and hind femora with the hair mainly pale, as also the long curled hairs in front of hind tibiae; hair of legs otherwise black. Facial quadrangle very much broader than long. Process of labrum truncate. Clypeus closely but finely punctured, with a smooth median line. Ocelli amber color. Facial foveae seen from above dark brown, occupying most of the space between eye and antenna, below they hardly extend below level of antennae. Antennae dark, third joint longer than next two together. Mesothorax and scutellum dull and granular. Area of metathorax without evident sculpture. Tegulae piceous. Wings brownish hyaline, nervures and the slender stigma reddish brown. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure near its end. Third submarginal long. First abdominal segment granular, but apparently not punctured, the others with fine punctures; second segment in middle depressed more than one-third; all the segments covered with long, shaggy hair; hair at apex sooty.

This is a variety of *A. pyrrhacita*, differing in the color of the hair.

Type.—Cat. No. 18150, U.S.N.M.

*b*⁵². Apical part of abdomen with black hair above.

ANDRENA BEBBIANA, new species.

Boulder, Colorado. March 30. (S. A. Rohwer.) At flowers of *Selix bebbiana*.

Female.—Length, 10½ mm. Black; the pubescence long, partly black, partly white, and partly pale fulvous. Head very broad, with long black hair, except that on occiput overlapping vertex, which is white. Process of labrum slightly emarginate. Clypeus very hairy, with a dull feebly punctured surface. Facial foveae seen from above black, rather broad, ending below a little below level of antennae. Flagellum obscure brownish beneath. Third antennal joint almost as long as next three together. Cheeks very broad. Mesothorax

and scutellum dull and granular. Area of metathorax poorly defined, granular. Hair of thorax above anteriorly almost white, but on scutellum becoming pale fulvous; grayish white on sides of metathorax, but black on pleura. Tegulae piceous. Wings dusky hyaline, nervures and stigma dark reddish. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure at beginning of last third. Hair of hind femora and tibiae beneath glistening white, but of hind knees and hind tibiae above gray, on inner side of hind tarsi pale reddish; anterior femora behind with long sooty hair. Abdomen shining, without distinct punctures, the broad hind margins of segments dark reddish; first two abdominal segments with long white hair, the others with long sooty hair, some pale hair on hind margin of third. No distinct bands.

A. pyrrhacita coloradensis and *A. bebbiana* are very closely allied, but differ in the process of labrum, and appear to be distinct species. *A. bebbiana* is very close to *A. ribesina* Cockerell, but is distinct by the entirely purplish-black hair of face and cheeks, etc.

b⁵¹. Not as under a⁵¹.

a⁵³. Rather small species, about 9–10 mm. long, superficially all much alike, without even rudimentary light hair bands on abdomen. Hair of thorax above ochreous or fulvous. Hair of cheeks black.

a⁵⁴. Abdomen purple.

(See *A. purpurina*, above.)

b⁵⁴. Abdomen black; hair of face black.

a⁵⁵. Basal part of abdomen with red or fulvous hair.

a⁵⁶. Hair of thorax above bright fox red.

ANDRENA RIBIFLORIS, new species.

Colorado.

Female.—Length, 9 mm. Black; thorax above and tubercles with very bright fox-red hair, vertex with pale reddish hair, otherwise the hair of head and thorax is black, except that at sides of metathorax and a little at upper end of pleura is red. Hair of legs black, pale reddish on anterior tarsi, and whitish with a smoky tinge on hind femora. First abdominal segment and basal half of second with long red hair, rest of abdomen with scanty short black hair. Facial quadrangle broader than long. Process of labrum emarginate. Clypeus with strong not very dense punctures. Facial foveae seen from above dark brownish gray, occupying about three-fourths space between eye and antenna, but narrowing below and ending a little below level of antenna. Antennae dark, rather slender. Third joint a little longer than next two combined. Mesothorax dull, hardly punctured. Area of metathorax with short feeble ridges at base. Tegulae dark reddish. Wings hyaline, faintly dusky, more dusky at apex. Stigma and nervures dull ferruginous. Basal nervure falling short of transverse median. Second submarginal cell receiving first recurrent nervure very near its end. Spurs cream

color. Abdomen shining, not punctured; hind margins of segments broadly dark brown; second segment in middle depressed more than one-third and less than one-half; hair at apex black.

(This is named as a separate species, but I believe it to be the true female of *A. ribifloris*. It is widely separated from female *hemileuca* in the table.)

Allotype.—Cat. No. 18144, U.S.N.M.

b⁵⁶. Hair of thorax above pale ochereous.

ANDRENA RIBIFLORIS, variety.

Florissant, Colorado. June 16, 1907. At flowers of *Ribes valliscola*. (S. A. Rohwer.)

Is identical with the insect just described, differing only in less brightly colored hair of thorax above.

The label states that it is a paratype, and that the type has fulvous hair.

Paratype.—Cat. No. 18144, U.S.N.M.

b⁵⁵. Basal part of abdomen without red or fulvous hair.

a⁵⁷. Second submarginal cell receives first recurrent nervure near end; clypeus with a median ridge.

ANDRENA RIBIFLORIS, new species.

Colorado.

Female.—Length, 10 mm., rather slender. Black, with black pubescence on head, pale ferruginous on upper side of thorax but sooty beneath, very dark brownish gray on legs and black at apex of abdomen. Head broad; facial quadrangle much broader than long. Process of labrum truncate. Mandibles red at extreme tip. Clypeus dull at base and sides, but otherwise shining, with sparse punctures and a median ridge. Front striate; facial foveae seen from above chocolate color, occupying at least two-thirds of space between eye and antenna, below they scarcely extend below level of antennae. Antennae very dark, third joint longer than next two combined, but not so long as next three. Mesothorax dull, with very minute feeble punctures. Scutellum dull, shining in front. Area of metathorax narrow, elongated apically with a few short basal ridges, the middle one longer. Tegulae reddish. Wings reddish hyaline, nervures and stigma ferruginous. Basal nervure not reaching transverse median. Second submarginal cell large, receiving first recurrent nervure near its end. Spurs very pale. Abdomen shining, entirely without hair bands; without evident punctures. Segments broadly margined posteriorly with dark brown, second segment in middle depressed more than a third. Hair at apex of abdomen black.

(A close study of this convinces me that it is *A. ribifloris*; it is in bad condition, and has lost part of its hair.)

Paratype.—Cat. No. 18144, U.S.N.M.

b⁵⁷. Second submarginal cell receiving first recurrent nervure in middle; clypeus with no distinct median ridge; base of abdomen without long hair.

ANDRENA (MERRIAM variety?) FULVINIGRA, new species.

Fort Collins, Colorado. April 24, 1903. (Gillette.)

Female.—Length, 9 mm. Black, with black hair except that on occiput and thorax above which is bright ferruginous; it is red on tubercles but black on pleura, but on metathorax it is red in middle, but black at sides; on inner side of hind tarsi it is chocolate color. Facial quadrangle very much broader than long. Process of labrum very broadly truncate, clypeus shining, with small punctures, sparse in middle. Facial foveae very narrow, seen from above light reddish, but reddish black at other angles, ending below at about level of antennae. Flagellum dark beneath; third antennal joint about as long as next three together, the fifth very short. Mesothorax dull, with very minute inconspicuous punctures. Surface of scutellum hidden by the very bright red hair. Area of metathorax feebly roughened, somewhat shining. Tegulae rather dark reddish. Wings brownish hyaline, nervures and stigma rather light reddish. Basal nervure meeting transverse median. Second submarginal cell very broad, receiving first recurrent nervure about middle. Long hair on outer side of hind femora dull whitish but that on knees and hind tibiae slaty black. Abdomen shining, without distinct punctures, and with little hair. No bands on hind margins of segments. Hair at apex slaty black.

(I have this also from Florissant, and considered it to be *A. merriami*. Mr. Viereck, who had access to the type of *merriami* associates them closely in the key, separating them thus:

Clypeus coarsely punctured.....	<i>merriami</i> .
Clypeus finely punctured.....	<i>fulvinigra</i> .

Type.—Cat. No. 18153, U.S.N.M.

*b*⁵³. Abdomen more or less banded; hair of cheeks light (partly dark in *topazana*).

*a*⁵⁸. Facial quadrangle longer than broad; a curious oblong head. Hair at apex of abdomen light reddish. (*A. campanulae*, with a rather narrow face, has hair at apex of abdomen sooty.)

(*A. cheyennorum*; see above under males.)

*b*⁵⁸. Facial quadrangle broader than long.

*a*⁵⁹. Large species with costoapical region of wings dark.

ANDRENA ARIZONENSIS, new species.

Oracle, Arizona. June 19, 1903. (Osler.)

Exactly like the black variety of *A. prunorum gillettei*, which occurs rarely at Boulder, Colorado, except that it is more finely punctured. It is probably a race of *A. prunorum*. It is quite distinct from *A. argemonis*.

Female.—Length, 12 mm. Black, the tarsi reddish at apex. Pubescence grayish white, pale yellowish on tarsi. Facial quadrangle broader than long. Process of labrum broadly truncate, very feebly emarginate. Clypeus brilliantly shining, sparsely punctured;

front striate. Facial foveae seen from above cream color, occupying two-thirds of distance between eye and antenna, below extending well below level of top of clypeus, little separated from eye. Antennae very dark; third joint longer than next two combined. Mesothorax shining, with small rather close punctures, the posterior middle with few punctures. Area of metathorax dull, with very delicate reticulation, which is mostly transverse, but there is a fine median raised line. Tegulae very dark brown. Wings with the lower half clear hyaline, the upper half orange tinted, the apex suffused with fuscous. Nervures and stigma clear ferruginous. Basal nervure falling short of transverse median. Second submarginal cell narrowed above, receiving first recurrent nervure a little beyond middle. Third submarginal very broad above. Legs with pale hair, very light yellowish on inner side of tarsi. Abdomen with a very obscure greenish tint, dullish, densely and minutely punctured, hind margins of segment narrowly reddish, segments 2-4 with dense white hair bands. Hair at apex pale reddish; second segment in middle depressed about one-third.

Type.—Cat. No. 18154, U.S.N.M.

b^{59} . Not as in a^{59} .

a^{60} . End of abdomen with sooty black hair (rather pale gray in autumnalis). Abdomen never conspicuously banded.

a^{61} . Hair of thorax above dull white.

a^{62} . Stigma dark; first recurrent nervure joins second submarginal about middle.

ANDRENA CAMPANULAE, new species.

War Bonnet, Sioux County, Nebraska. On *Campanula*. June 28, 1901. (M. A. Carriker.)

Female.—Length, 9 mm. Black, with pale gray hair. Facial quadrangle about as broad as long. Process of labrum broadly truncate. Clypeus minutely granular, with sparse rather shallow punctures. Facial foveae seen from above pale grayish, narrow, ending below a little below level of antennae. Flagellum faintly reddish beneath. Third antennal joint almost as long as next three together, but the fourth and fifth are very short. Mesothorax and scutellum dull, without distinct punctures. Area of metathorax granular, its apical margin shining. Tegulae rufopiceous. Wings dusky; nervures and stigma very dark reddish. Basal nervure falling just short of transverse median. Second submarginal cell receiving first recurrent nervure a little beyond middle. Hair of hind tibiae brownish or grayish white; hair on inner side of tarsi pale grayish brown. Abdomen moderately shining, not punctured; second segment in middle depressed hardly one-third; hind margins of second to fourth segments with white hair bands, on second and third interrupted in middle; hair at apex brownish gray.

Male.—Sioux County, Nebraska. July.

Length, 7 mm. Resembles female in everything except usual sexual differences. Face entirely black; cheeks normal. Apical plate small, hidden in a tuft of creamy white hair.

For fuller description of male see above.

^{b62}. Stigma ferruginous; first recurrent nervure joins second submarginal cell beyond middle.

ANDRENA AUTUMNALIS, new species.

Lincoln, Nebraska. September.

Female.—Length, 11 mm. Black, the legs very dark reddish. Pubescence grayish white. Facial quadrangle broader than long; process of labrum emarginate; clypeus shining, sparsely and weakly punctured in middle, more closely on sides. Facial foveae as seen from above pale seal brown, almost half as broad as distance from eye to antennae, ending broadly below, a trifle below level of antennae and not diverging from eye. Front striate. Flagellum dark reddish. Third antennal joint about as long as fourth and fifth together. Mesothorax dull, with very sparse weak punctures. Scutellum broad and flat, smooth and shiny. Area of metathorax small, without evident sculpture. Tegulae rather pale brown. Wings reddish hyaline, stigma and nervures amber color. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure at about beginning of last third. Hair on outer side of tibiae and tarsi sooty. Middle femora very sharply keeled beneath, with a long white fringe. Hair on inner side of hind tarsi very dark brown; spurs cream color. Abdomen impunctate, the hind margins of the segments whitish, with very thin bands, with long white hair. Hair at apex sooty.

Very close to *A. runcinatae* Cockerell, but distinct. *A. runcinatae* is smaller and has a good deal of black hair on thorax above.

Type.—Entomological collection of the University of Nebraska.

^{b61}. Hair of thorax above ochreous; first recurrent nervure joins second submarginal cell much beyond middle, or nearly at end.

ANDRENA TOPAZANA Cockerell,

Grangeville, Idaho.

Female.—Length, 10 mm. Black, small joints of the tarsi reddish. Pubescence pale ochreous. Facial quadrangle broader than long. Process of labrum broadly truncate. Clypeus shining, very sparsely but distinctly punctured. Facial foveae seen from above dark, occupying at least two-thirds distance between eye and antenna, below going short distance below level of antennae. Flagellum chestnut red beneath. Third antennal joint a little longer than next two combined. Mesothorax and scutellum dull, hardly punctured. Area of metathorax granular. Tegulae dark reddish. Wings quite strongly brownish; stigma and nervures ferruginous. Basal nervure falling

short of transverse median. Second submarginal rather narrow, receiving first recurrent nervure almost at its end. Third submarginal very broad above. Femora with pale hair, tibiae and tarsi with grayish brown; the creamy white shining hair of the hind femora contrasts abruptly with the dark brown hair of their tibiae, but the tuft on the knees is dark gray brown. Abdomen dullish, not punctured, with scattered rather long pale hair, not forming bands. Hair at apex sooty. Second segment in middle depressed nearly one-half.

(Comparison with the type of *A. topazana* shows that this is strictly identical.)

(The following is also, in my opinion, true *A. topazana*, although there are some small differences, as the descriptions indicate.)

Georgetown, Colorado. (C. F. Baker, 5983.)

Female.—Length, 9 mm. Black, tarsi reddish at apex. Pubescence pale ochreous, darker on thorax above, largely sooty on outer side of tibiae, especially hind tibiae. Facial quadrangle much broader than long. Clypeus shining, with sparse strong punctures. Facial foveae grayish, occupying more than half space between eye and antenna, below they end a little below level of antennae. Antennae dark, the flagellum rather dark brownish toward end. Third antennal joint about as long as next two together. Mesothorax dull, without evident punctures. Area of metathorax granular. Tegulae piceous. Wings brownish hyaline, nervures and stigma dull reddish brown. Basal nervure meeting transverse median. Second submarginal cell narrow, receiving first recurrent nervure not far from end. Abdomen impunctate, thinly hairy, without evident bands. First two segments dull, the others shining, as also apical margin of second. Hair at apex sooty.

b^{60} . End of abdomen with pallid or reddish hair.

a^{63} . Hind tibiae and tarsi clear red (tarsi red in astragali and medionitens variety a).

All have the abdomen quite distinctly banded except lincolnella.

a^{64} . Abdomen very distinctly punctured; margins before depression red; stigma small. (The abdomen suggests aureocincta, but the wings are quite different.)

ANDRENA ASHMEADI, new species.

Colorado. (C. F. Baker, No. 1591.)

Female.—Length, about 10 mm. Black, with the depressed portions of the abdominal segments light testaceous, ferruginous where they join the black. Hind tibiae, and middle and hind tarsi, light ferruginous. Pubescence pale ochreous, becoming white beneath. Facial quadrangle a little broader than long, distinctly broader above than below. Mandibles chestnut red except at base. Process of labrum strongly emarginate. Clypeus dullish, rather strongly but not densely punctured, with a narrow impunctate but not shining line. Facial foveae seen from above very pale brownish, occupying

more than two-thirds distance between eye and antenna; they rapidly narrow below and end in an obtuse point a little below level of antennae. Flagellum very dark reddish beneath. Third antennal joint about as long as next two together. Hair on scutellum clear light fulvous. Mesothorax and scutellum moderately shining, with small not very dense punctures. Area of metathorax granular. Hair of hind tibiae pale reddish, very strongly plumose. Abdomen shining, finely and distinctly punctured. Hind margins of segments, including first, with complete cream-colored hair bands. Hair at apex of abdomen cream color.

Type.—Cat. No. 18156, U.S.N.M.

*b*⁶⁴. Not as under *a*⁶⁴.

*a*⁶⁵. Stigma small and narrow; wings rather milky; species flying in October.

ANDRENA LINCOLNELLA, new species.

Lincoln, Nebraska. October.

Female.—Length, 12 mm. Head and thorax black; antennae, legs and abdomen dark reddish. Hind tibiae and tarsi honey color. Pubescence pale, slightly ochreous above. Facial quadrangle broader than long. Process of labrum broadly truncate. Clypeus shining, except at sides, and with rather small punctures, which are sparse in the middle. Facial foveae seen from above creamy white; they are very broad above but rapidly narrow below, ending about level of antennae and a little separated from eye. Third antennal joint about as long as the next three together. Mesothorax and scutellum dull, without evident punctures. Area of metathorax dull and granular. Tegulae light testaceous. Wings hyaline, distinctly milky, the narrow small stigma and the nervures ferruginous. Basal nervure falling a little short of transverse median. Second submarginal cell broad, receiving first recurrent nervure far beyond middle; hair of hind tibiae very pale yellowish, spurs light ferruginous. Abdomen dull and granular, without distinct punctures. Hind margins of segments hyaline; the abdomen above is nearly free from hair except the bands of long white hair on hind margins of second and following segments, very broadly interrupted on second and thin or absent on middle of third. Second segment in middle depressed about one-third. Hair at apex light ochreous.

Type.—Entomological collection of the University of Nebraska.

*b*⁶⁵. Stigma ordinary; species flying May–July.

*a*⁶⁶. Hair at apex of abdomen bright orange-fulvous; wings very red.

ANDRENA ASTRAGALI, new species.

Bad Lands, Mouth of Monroe Canon, Sioux County, Nebraska. June 6, 1901. On *Astragalus*. (M. A. Carriker, jr.)

Female.—Length, 12 mm. Black, the tarsi ferruginous. Pubescence creamy white. Facial quadrangle broader than long. Process

of labrum very peculiar, being very broad with the apical margin concave and the apical corners projecting. Clypeus irregularly punctured, surface almost hidden by hair. Facial foveae seen from above grayish white, occupying about half space between eye and antenna, below scarcely extending below level of antenna. Flagellum short and thick, obscure reddish beneath. Third antennal joint longer than next two together, but the next is extremely short. Mesothorax dull, not punctured. Scutellum slightly shining. Area of metathorax granular, extremely small. Tegulae light rufotestaceous. Wings strongly reddened, dusky at apex. Stigma and nervures ferruginous. Basal nervure meeting transverse median. Second submarginal cell broad, receiving first recurrent nervure in middle, hair on hind tibiae very pale yellowish. Abdomen dullish, not punctured, the hind margins of the segments narrowly white, the junction of the white and black reddish. Segments with long, thin, glittering hair, not hiding the surface. Hind margins with broad white hair bands, scanty on first segment. Hair at apex light ferruginous. Second segment in middle depressed about two-fifths.

In the key this falls in a couplet with *A. davidsoni*, from which it is separated by the dull dorsulum.

*b*⁶⁶. Hair at apex of abdomen not thus bright.

*a*⁶⁷. Larger; anterior tarsi red; head very broad.

ANDRENA PEREZANA, new species.

Lincoln, Nebraska. May.

Female.—Length, about 12 mm. Black, with the hind tibiae and all the tarsi, as well as the anterior tibiae on inner side except at base, the middle tibiae at apex, and the sides of the abdomen near base beneath, ferruginous, the tarsi very bright and clear. Pubescence grayish white, not at all yellowish dorsally. Head very broad, process of labrum broadly truncate. Clypeus shining, finely and closely punctured, with a slender median smooth line. Facial foveae seen from above cream white, occupying at least two-thirds of space between eye and antenna; below they do not go below level of antennae. Flagellum reddish brown beneath. Third antennal joint slightly longer than the next two combined. Mesothorax and scutellum shining, with extremely minute scattered punctures. Area of metathorax granular. Tegulae reddish. Wings strongly reddened, nervures and the rather small stigma ferruginous. Basal nervure falling short of transverse median. Second submarginal cell receiving first recurrent nervure at beginning of last third. Hair on hind tibiae shining white. Abdomen shining, the hind margins of the segments red; no punctures; very little hair except at base and apex, and on the hind margins of the segments, where there are broad but thin

white hair bands; hair at apex light yellowish. Second segment in middle depressed about two-fifths.

Type.—Entomological collection of the University of Nebraska.

*b*⁶⁷. Anterior tarsi not red; species smaller than *A. perezana*.

*a*⁶⁸. Area of metathorax wrinkled.

(See *A. titusi* in *Trachandrena*, above.)

*b*⁶⁸. Area of metathorax not at all wrinkled.

*a*⁶⁹. Facial foveae very narrow; abdominal hair-bands (on segments 2-4) white and entire; first recurrent nervure joins second submarginal cell at middle.

ANDRENA MONTROSENSIS, new species.

Montrose, Colorado. May 5, 1901. (Gillette.)

Female.—Length, 9 mm. Black, with white hair. Hind tibiae and tarsi clear ferruginous, with pale yellow hair. Facial quadrangle a little broader than long. Process of labrum very narrowly truncate. Mandibles with the apical half red. Clypeus shining except at sides, well punctured, with no smooth line. Facial foveae seen from above pale reddish, narrow, ending below about level of top of clypeus. Flagellum ferruginous beneath except at base. Third antennal joint not as long as next three combined. Mesothorax sparsely punctured, dull in front, shining in middle and posteriorly. Scutellum shining. Area of metathorax granular. Tegulae dark reddish. Wings dusky hyaline, darker apically; nervures testaceous, the outer ones fuscous; stigma light amber color. Basal nervure falling a little short of transverse median. Second submarginal cell broad, receiving first recurrent nervure about the middle. Hair on inner side of hind tarsi shining pale golden. Abdomen dullish, not punctured; hind margins of second and following segments with broad entire white hair bands. Hair at apex pale reddish.

In the key this is separated from *A. costillensis* and *apacheorum* on the venation, the second submarginal cell receiving the first recurrent nervure beyond the middle in those species. From *A. canadensis* it is separated by the dullish dorsulum, that of *canadensis* being shining. The general appearance is that of *A. canadensis*.

Type.—Cat. No. 18157, U.S.N.M.

*b*⁶⁹. Facial foveae not especially narrow; abdominal hair-bands not clear white; first recurrent nervure joining second submarginal cell beyond middle.

ANDRENA MEDIONITENS Cockerell, variety *A.*

Westlake, Colorado. July 7, 1900. (Gillette.)

Female.—Length, 8 mm. Black, with very pale ocherous pubescence. Facial quadrangle broader than long. Process of labrum emarginate. Mandibles bright chestnut red apically. Clypeus shining, rather sparsely punctured, with a smooth median line. Facial foveae seen from above brownish white, rather broad, ending

below at about level of antennae. Flagellum dark red beneath; third antennal joint not as long as next three combined. Mesothorax moderately shining, with weak punctures. Area of metathorax granular. Tegulae rufopiceous. Wings dusky hyaline. Nervures and stigma amber color. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure well beyond middle. Middle and hind tarsi red. Hair of hind tibiae yellowish white. Abdomen dullish, not punctured. Second segment in middle depressed less than one-third. Second and following segments with thick yellowish white hair bands. Hair at apex very pale reddish brown.

Resembles *A. montrosensis*, but the facial foveae are broader. They are very closely allied.

(This differs from typical *A. medionitens* by the redder, and I think rather narrower, facial foveae, and red middle tarsi, but I can not believe it to be a distinct species. In the key it falls in a couplet with *perezana*, from which it is separated thus:

Scopa appressed and hiding tegument.....*perezana*.

Scopa not appressed, not hiding tegument; tarsi stramineous..*medionitens*, variety a.)

b⁶³. Hind tibiae and tarsi not clear red. (Tarsi red in *astragali* and *medionitens*, variety a.)

a⁷⁰. Large species, considerably over 10 mm. long, with conspicuous white hair-bands; species superficially similar.

a⁷¹. Wings orange. (See *A. astragali*, above.)

b⁷¹. Wings not at all orange.

ANDRENA TOWNSENDI, new species.

Dripping Spring, Organ Mountains, New Mexico. August 10. (C. H. T. Townsend.)

Female.—Length, 13 mm. Black, the tarsi brownish, their small joints becoming ferruginous as well as the anterior knees. Pubescence grayish white, clear ochereous on thorax above. Facial quadrangle broader than long. Process of labrum strongly emarginate. Clypeus shiny, sparsely punctured, with a poorly defined smooth median band. Facial foveae seen from above light ochreous, moderately broad, ending broadly below at about level of top of clypeus. The clypeus is very high and the supraclypeal area very small, so that the antennae are inserted very near to the top of the clypeus. Scape reddish at base; flagellum obscurely reddish beneath. Third antennal joint a little shorter than next three combined. Mesothorax dull and granular, scarcely punctured. Scutellum shining in front. Area of metathorax granular, with a depressed median line. Tegulae rufopiceous. Wings brownish hyaline, the nervures and small stigma reddish, the stigma very dark. Basal nervure falling short of transverse median. Second submarginal very broad, receiving first recurrent nervure slightly beyond middle. Hair of hind

tibiae white; on inner side of hind tarsi pale golden. Abdomen dullish, without punctures, all the segments with broad entire white hair bands. Hair at apex stained with brown.

In the key, this falls in a couplet with *A. complexa*, and is separated thus:

Abdominal segments greenish; pubescence pale, whitish.....*complexa*.

Abdominal segments black; pubescence yellowish.....*townsendi*.

*b*⁷⁰. Much smaller species than under *a*⁷⁰.

*a*⁷². Species like *A. hirticincta*, with long yellow hair; the broad entire abdominal bands as wide as the intervals between them.

ANDRENA COSTILLENSIS, new species.

Colorado. No. 2294.

Female.—Length, 9 mm. Black, with abundant long hair, which is bright yellowish on thorax above, elsewhere paler, and beneath inclining to grayish white. The caudal fimbria pale, like the very thick and broad abdominal bands. Facial quadrangle broader than long; process of labrum broad, shallowly emarginate; clypeus strongly and rather closely punctured, with rather indistinct median smooth line. Facial foveae seen above pale ochereous, occupying more than half the space between antenna and eye, their lower end level with top of clypeus, and separated only by a shining line from the eye. Flagellum dark reddish beneath. Third antennal joint fully twice as long as fourth; fifth about equal to fourth. Mesothorax dullish, very hairy. Anterior half of scutellum shining; area of metathorax granular, defined only by absence of hair. Tegulae shining piceous, very hairy. Wings hyaline, slightly dusky, stigma light amber, nervures fuscous; basal nervure meeting transverse median; first recurrent nervure joining the nearly square second submarginal very near its end. Third submarginal long. Legs distinctly brownish; spurs cream color. Middle basitarsi remarkably broadened and flattened. Abdomen dullish, hardly punctured, second segment in middle depressed about two-fifths.

Also collected in the Costilla Mountains, New Mexico, August 16, 1899 (Miss Mize), and at Eldora, Colorado, August 18, 1910, at flowers of *Grindelia* and *Erigeron*, by T. D. A. and W. P. Cockerell.

In the key, this falls in a couplet with *A. apacheorum* Cockerell, and is separated thus:

Scutellum dull; fimbria brown.....*apacheorum*.

Scutellum shining, partly polished; fimbria ochreous.....*costillensis*.

Type.—Entomological collection of the University of Nebraska.

*b*⁷². Not as under *a*⁷².

*a*⁷³. Without distinct light abdominal bands. None of the species very small.

*a*⁷⁴. Hair of thorax short; grayish white; wings unusually short.

ANDRENA RADMITRICA, new species.

Lincoln, Nebraska. October

Female.—Length, $9\frac{1}{2}$ mm. Black, the legs very dark reddish brown. Pubescence dull white. Facial quadrangle about as broad as long. Process of labrum narrow, emarginate. Apical half of mandibles dark red; clypeus dullish, sparsely and feebly punctured. Facial foveae seen from above grayish white, a little yellowish as seen from upper end, about one-half as broad as distance between eye and antenna, ending in a point at level of antennae and a little away from eye. Front striate, elevated in middle. Flagellum chestnut red beneath; third antennal joint about as long as the following three together. Mesothorax moderately shiny, with very sparse feeble punctures. Scutellum microscopically tessellate, shining like mesothorax, but hardly at all punctured. Area of metathorax granular, scarcely defined. Tegulae reddish, with a dark spot. Wings unusually short, dusky hyaline, nervures and the small stigma dark red brown. Basal nervure meeting transverse median. Second submarginal cell broad, receiving first recurrent nervure well beyond middle. Third submarginal rather short. Spurs creamy white. Hind tibial scopa loose, of pure white branched hairs. Hairs on inner side of hind tarsi shining dark brownish gray. Abdomen dullish, not evidently punctured; hind margins of segments narrowly pallid, with weak indications of hair bands; hair at apex brownish white.

In the key this runs next to *A. solidaginis*, from which it is known by the light caudal fimbria.

Type.—Entomological collection of the University of Nebraska.

*b*⁷⁴. Hair of thorax fulvous or ferruginous; first recurrent nervure joins second submarginal cell almost at end.

*a*⁷⁵. Larger; hair of hind tibiae entirely cream color.

ANDRENA PAENEFULVA, new species.

Colorado.

Female.—Length, 10 mm. Black, with rather light fulvous hair, which is long and loose. Facial quadrangle broader than long. Process of labrum deeply emarginate. Clypeus shining, strongly but not closely punctured, with a smooth median line. Facial foveae seen from above pale seal brown, occupying more than one-half space between eye and antenna, not much narrowed below, where they end a little below level of antennae. Flagellum dull red beneath. Third antennal joint not as long as next three together. Mesothorax granular, somewhat shining, with very feeble obscure punctures. Scutellum shining anteriorly, but its posterior part and the post-scutellum granular and entirely dull, as also the poorly defined area of the metathorax. Tegulae dark reddish, with long hair. Wings reddish hyaline, nervures and stigma rather light reddish. Basal

nervure falling short of transverse median. Second submarginal cell broad; receiving first recurrent nervure almost at its end. Hair on hind tibiae pale ocherous or almost cream colored, shining. Abdomen finely granular, without evident punctures, the thin loose hair hardly forming distinct bands; second segment in middle depressed more than two-thirds but less than one-half; hair at apex light reddish ochreous.

Type.—Collection of the American Entomological Society.

*b*⁷⁵. Smaller; hair of hind tibiae longitudinally bicolored, sooty brown and pale fulvous.

ANDRENA SALICICOLA, new species.

Halfway House, Pikes Peak, Colorado. On *Salix*. May 30, 1904. (Cockerell.)

Female.—Length nearly 9 mm. Black. Pubescence long, pale ferruginous, very bright on thorax above. Facial quadrangle broader than long. Process of labrum emarginate. Clypeus shining, sparsely punctured. Facial foveae seen from above very dark brown, occupying two-thirds space between eye and antenna, below they end a little below level of antennae. Flagellum dark reddish beneath. Third antennal joint about as long as next two combined. Mesothorax and scutellum dull, without evident punctures, the median and parapsidal lines on mesothorax shining. Area of metathorax scarcely defined, obscurely wrinkled at base. Tegulae dark brown. Wings hyaline, slightly dusky at apex. Stigma and nervures reddish sepia. Basal nervure falling a little short of transverse median. Second submarginal cell receiving first recurrent nervure almost at apex. Third submarginal very long. Hind tarsi reddish. Hair on hind tibiae pale reddish anteriorly and pale sooty posteriorly, the colors abruptly contrasting. Abdomen shining, not punctured, with thin long hair but no bands. Hair at apex pale but slightly sooty. Second segment in middle depressed nearly one-half.

Very closely allied to *A. paenefulva*.

In the key, *A. salicicola* falls near *A. asmi*, and is separated thus:

Foveae black; pleurae with pale pubescence.....	<i>asmi</i> .
Foveae dark brown; scopa partly brown and compact.....	<i>salicicola</i> .

Type.—Cat. No. 18161, U.S.N.M.

*b*⁷³. With distinct light hair bands on abdomen.

*a*⁷⁶. Wings strongly red-brown; first recurrent nervure joins second submarginal cell about middle; facial foveae light reddish, very narrow.

ANDRENA DAVIDSONI, new species.

Mount Wilson, Southern California. (Davidson.)

Female.—Length, 9 mm. Black, with pale ocherous pubescence. Facial quadrangle broader than long. Process of labrum truncate, the truncation slightly concave. Clypeus finely granular, with numerous shallow punctures. Facial foveae seen from above very

light reddish, extremely narrow, ending below just below level of antennae. Antennae dark. Third joint not as long as next three combined; fourth and fifth very short. Mesothorax and scutellum shiny, with very fine punctures. Area of metathorax granular, not distinctly defined. Wings strongly reddish, nervures and stigma dark ferruginous. Basal nervure almost reaching transverse median. First recurrent nervure received by second submarginal cell a little before the middle. Hair of hind tibiae shining pale yellow. Abdomen shining, not distinctly punctured; segments 1 to 4 with conspicuous entire white hair bands. Hair at apex light reddish.

In the key, this falls in a couplet with *A. astragali*, from which it is separated by the shining dorsulum.

b⁷⁶. Wings normal.

a⁷⁷. Second submarginal cell remarkably broad, broader than high, receiving first recurrent nervure about middle; stigma large; facial foveae light reddish, narrow.

ANDRENA NIGRITARSIS, new species.

Boulder, Colorado. May 27, 1906. (S. A. Rohwer.)

Female.—Length, 8 mm. Black, with light ochereous pubescence. Facial quadrangle much broader than long. Process of labrum small and broadly rounded. Clypeus shining, not densely punctured, with no smooth line or ridge. Facial foveae seen from above light red, very narrow, ending below at about level of top of clypeus. Flagellum dark red beneath except at base. Third antennal joint scarcely as long as next two combined. Mesothorax dull, with feeble minute punctures. Scutellum shining, with very sparse and small punctures. Area of metathorax rather coarsely roughened. Tegulae ferruginous. Wings reddish hyaline, nervures and the large stigma ferruginous. Basal nervure falling a little short of transverse median. Second submarginal cell very broad, with parallel sides, receiving first recurrent nervure at or a little beyond the middle. Hair of hind tibiae very pale ochereous or almost grayish white; on inner side of hind tarsi golden. Abdomen shining, not punctured; hind margins of second and following segments reddened; second segment in middle depressed about two-fifths, but feebly. Rudimentary hair bands at sides of second and following segments. Hair at apex light reddish.

Falls in key in the vicinity of *A. melanochoa*, *A. apacheorum*, etc.

b⁷⁷. Second submarginal cell not formed as under a⁷⁷.

a⁷⁸. Facial foveae ochreous or reddish.

a⁷⁹. Basal nervure falling short of transverse median; hair of thorax grayish white; species about 8 mm. long.

ANDRENA COLORADINA, new species.

Colorado. (C. F. Baker, No. 1900.)

Female.—Length, 8 mm. Black, with pale grayish hair, that on the scutellum slightly fulvous. Facial quadrangle broader than long.

Process of labrum broadly truncate. Clypeus shining, well punctured, without any smooth line. Facial foveae seen from above very light grayish brown, occupying about two-thirds space between eye and antenna, ending below a little below level of antennae. Flagellum obscure brownish beneath, shorter than usual. Third antennal joint not as long as next three combined. Mesothorax dull in front, but the posterior two-thirds and the scutellum shining, with very feeble punctures. Area of metathorax dull and granular, scarcely defined. Tegulae dark reddish, wings hyaline, nervures rather dark reddish, but the large stigma bright ferruginous. Basal nervure falling just short of transverse median. Second submarginal cell receiving first recurrent nervure beyond middle. Tarsi brownish, clear red at apex. Abdomen broad, shining, without evident punctures; hind margins of segments reddish brown; second segment in middle depressed about one-third or slightly more. Second and following segments with distinct white hair bands, broadly interrupted on second. Hair at apex creamy white.

(There are two specimens, with the same number. Another specimen (Colorado, Gillette, No. 2094) was given a different name, but is the same species. The color of the facial foveae is rather variable, and the insect may be sought in a section below, as is there indicated. In the key this species falls close to *A. subdistans*, from which it is separated by the dark brown hind tibiae.)

A. phocata Cockerell is extremely close to *A. coloradina*, but distinct. *A. phocata* differs by being a little larger, with orange-tinted wings; broad smooth band on middle of clypeus; facial foveae seal brown above, white below.

Type.—Cat. No. 18162, U.S.N.M.

*b*⁷⁹. Basal nervure meeting transverse median; thoracic hair ochreous or fulvous; rather larger than *A. coloradina*.

*a*⁸⁰. Clypeus with a distinct median ridge, and large punctures; hair bands of abdomen pale ochreous.

ANDRENA FULVIHIRT, new species.

Colorado. (Gillette, 2091.)

Female.—Length, 9 mm. Black, with the pubescence fulvous, including that of the abdominal bands. Facial quadrangle broader than long. Process of labrum truncate, the truncation somewhat concave. Clypeus shining, with large irregular punctures and a fine median ridge. Facial foveae seen from above pale reddish, moderately broad, ending below at about level of top of clypeus. Flagellum very obscurely brownish beneath. Third antennal joint not so long as next three together. Mesothorax dullish, feebly punctured. Area of metathorax granular. Tegulae dark reddish. Wings clear hyaline, faintly dusky at apex. Stigma and nervures amber color, the stigma large and very bright. Basal nervure meeting transverse

median. Second submarginal cell receiving first recurrent nervure far beyond middle. Middle and hind tarsi dark reddish. Abdomen shining, not punctured; second segment depressed in middle about two-fifths; second and following segments with thick pale hair bands, that on second rather broadly and on third very narrowly interrupted in middle. Hair at apex of same color.

Type.—Cat. No. 18163, U.S.N.M.

*b*⁸⁰. Clypeus without a distinct median ridge.

*a*⁸¹. Clypeus dullish; third submarginal cell on upper side not as long as second transverse cubital.

ANDRENA BRACHYCARPAE, new species.

Florissant, Colorado. June 1, 1907. (S. A. Rohwer.) At flowers of *Salix brachycarpa*.

Female.—Length, 9 mm. Black, with light ochereous pubescence. Facial quadrangle broader than long. Process of labrum narrowly truncate, but the truncation depressed in middle, so as to give a slight appearance of emargination. Clypeus shining, rather sparsely punctured. Facial foveae seen from above light reddish, quite narrow, ending below at level of antennae. Antennae dark, third joint not as long as next three combined, but a little longer than next two. Mesothorax dull and granular; scutellum more shining. Area of metathorax minutely wrinkled, not defined. Tegulae piceous. Wings reddish hyaline. Stigma and nervures ferruginous. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure well beyond middle. Hair of hind tibiae pale ochereous, reddish sooty at base; on inner side of hind tarsi light golden. Abdomen shining, without distinct punctures; hind margins of segments brownish; segments 2 to 4 with rather thin hair bands, and the surfaces of segments 3 to 6 thinly hairy all over. Hair at apex light reddish.

In the key this falls in a group, which also includes *A. decussata*, *A. perezana*, *A. astragali*, *A. davidsoni*, and *A. personata*. It is distinguished from all these by the following combination of characters: Scopa appressed and hiding tegument; inclosure of metathorax rugose; abdominal fasciae indistinct, but nevertheless more or less developed.

*b*⁸¹. Clypeus shining; third submarginal cell on upper side as long (or almost) as second transverse cubital nervure; middle and hind tarsi red.

(See *A. medionitens* variety a, above.)

*b*⁷⁸. Facial foveae white or whitish.

*a*⁸². Small species, 8 mm. long or less; first recurrent nervure joining second submarginal cell at middle or not much beyond.

*a*⁸³. Facial foveae a little broader; abdomen seems faintly metallic.

(See *A. coloradina*, described above.)

*b*⁸³. Facial foveae a little narrower.

ANDRENA COLORADINA, variety A.

Fort Collins, Colorado. May 8, 1903. (Gillette.)

Female.—Length, 8 mm. Black, small joints of tarsi ferruginous; the hind margins of the abdominal segments dark reddish. Pubescence white, except on thorax above, where it is pale ochereous, and pale reddish at end of abdomen. Facial quadrangle broader than long. Process of labrum narrow and rounded at end. Clypeus shining, with numerous punctures. Facial foveae seen from above white, moderately broad, ending below a little below level of top of clypeus. Flagellum dull reddish beneath. Third antennal joint shorter than next three together, fourth joint very short. Mesothorax and scutellum dullish, without evident punctures. Area of metathorax granular. Tegulae dark reddish. Wings clear hyaline; nervures and stigma amber color. The type-specimen has the second transverse cubital wanting on one side. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure in middle. Hair on hind tibiae and on inner side of hind tarsi shining white. Abdomen moderately shining, not punctured, interrupted white hair bands rather poorly developed on segments 2 and 3 and an entire one on fourth.

A. fragiliformis Cockerell is a little larger, with orange-tinted wings, rough and dull mesothorax, and narrower facial foveae. It is quite distinct.

Paratype.—Cat. No. 18162, U.S.N.M.

*b*⁸². Larger species, much more than 8 mm. long.

*a*⁸⁴. Abdomen very finely punctured, with a faint greenish tint; facial foveae rather narrow; second submarginal cell receiving first recurrent nervure at middle.

ANDRENA ANTONITONIS, new species.

Antonito, Colorado. August 5, 1899. (Gillette.)

Female.—Length, 10 mm. Black, rather slender; the front faintly greenish. Pubescence grayish white. Facial quadrangle broader than long. Process of labrum narrowly truncate. Clypeus shining, with sparse small punctures and an indistinct median ridge. Facial foveae seen from above brownish white, occupying about half distance between eye and antenna; seen from the side the foveae appear dark brown; they extend scarcely narrowed just below level of antennae and are very narrowly separated from eye. Flagellum obscure brownish beneath. Third antennal joint as long as next two combined. Mesothorax dull in front, shining posteriorly, with scattered small punctures. Scutellum shining. Area of metathorax granular. Tegulae ferruginous, with a fuscous spot. Wings reddish hyaline, nervures and the rather small stigma ferruginous. Basal nervure just falling short of transverse median. The very broad second sub-

marginal cell receiving first recurrent nervure at or little before middle. Hair on hind tibiae and on inner side of hind tarsi white, faintly yellowish on the tarsi. Spurs cream color. Abdomen dullish, with excessively minute punctures. Segments 2-4, with broad entire white hair bands. Hair at apex very pale yellowish. Second segment in middle depressed less than a third.

This is very like *A. synthyridis* Cockerell; they agree in the foveae, but *antonitonis* has the middle of mesothorax shining and sparsely punctured, while *synthyridis* has it duller and more closely punctured. They also differ in the minute sculpture of abdomen, and are certainly distinct species. In the key, *A. antonitonis* falls in a couplet with *A. perindotata*, from which it is separated by the polished clypeus.

Type.—Cat. No. 18164, U.S.N.M.

*b*⁸⁴. Abdomen very finely punctured, shining black. *A. gardineri* Cockerell.

*c*⁸⁴. Abdomen not punctured, and with no greenish tint.

*a*⁸⁵. Abdominal bands broad and gray; hair of hind tibiae longitudinally bicolored, white and fulvous.

ANDRENA LEWISII Cockerell, variety *A.*

Florissant, Colorado. June 23. On *Salix brachycarpa*. (S. A. Rohwer.)

Female.—Length, 9½ mm. Black. Pubescence ocherous, beneath and on face dull white. Facial quadrangle broader than long. Process of labrum emarginate. Clypeus shining, with strong irregular punctures and a smooth median line. Facial foveae seen from above very pale brownish, moderately broad, ending below at about level of top of clypeus. Antennae dark; third joint scarcely longer than next two combined. Mesothorax granular, without distinct punctures. Scutellum shining, with a median groove. Area of metathorax granular, scarcely defined. Tegulae piceous. Wings hyaline, faintly dusky, stigma and nervures amber color. Basal nervure falling short of transverse median. Second submarginal cell receiving first recurrent nervure beyond middle. Hair of hind tibiae brownish fulvous above and white beneath, on inner side of hind tarsi pale golden. Abdomen moderately shining, not punctured; second to fourth segments with broad bands of dull white hair and a somewhat imperfect band on first. Second segment in middle depressed about one-third. Hair at apex light reddish.

(Except for the bicolored hair of hind tarsi, this exactly agrees with *A. lewisii*. It is certainly the same species.)

*b*⁸⁵. Abdominal bands narrow and white; hair on hind tibiae shining white, not bicolored.

ANDRENA TRAPEZOIDINA, new species.

War Bonnet, Sioux County, Nebraska. May 27, 1901. (M. A. Carriker.)

Female.—Length, $9\frac{1}{2}$ mm. Black, with grayish white hair, very faintly yellowish on thorax above. Facial quadrangle much broader than long. Process of labrum rounded at end, the sides strongly concave. Clypeus minutely granular, with small not dense punctures. Facial foveae seen from above white, quite broad, ending below at about level of top of clypeus. Flagellum except at base rather bright red beneath. Third antennal joint shorter than next three combined. Mesothorax dull, not distinctly punctured, somewhat shining posteriorly. Scutellum shining. Area of metathorax coarsely roughened, scarcely defined, nearly all the metathorax covered with hair. Tegulae reddish. Wings reddish, stigma and nervures ferruginous. Basal nervure meeting transverse median. Second submarginal cell receiving first recurrent nervure near its end. Hair of hind tibiae shining white; hair on inner side of hind tarsi creamy white. Abdomen shining, not punctured, narrow hind margins of segments testaceous. Second segment in middle depressed about one-third. Segments 2 to 4 with white hair bands, that on 2 interrupted in middle. Hair at apex pale grayish brown. Rather like *A. campanulae* from same locality, but easily distinguished by the broad face, color of nervures, etc.

[This appears to be a race or subspecies of *A. sapellonis* Cockerell, from which it differs by the clearer, reddish hair at apex of abdomen, and absence of a smooth keel in middle of clypeus. Superficially, it is just like a specimen of *A. nudiscopa* Viereck (det. Viereck) from Fort Collins, Colorado, June 12, 1900 (Gillette); but the abdomen is brilliantly shining in *trapezoidina*, perfectly dull in *nudiscopa*.]

Type.—Entomological collection of the University of Nebraska.

THE CRUSTACEA EUPHAUSIACEA OF THE UNITED STATES NATIONAL MUSEUM.¹

By H. J. HANSEN,
Of Copenhagen, Denmark.

In 1911 I published a paper entitled: The Genera and Species of the order Euphausiacea, with Account of Remarkable Variation.² Every valid species hitherto established was enumerated, and preliminary descriptions were given of a number of new forms and of some little known species. At that time the order comprised 73 species. The previous year my treatise on the Euphausiacea gathered by the *Siboga* expedition had been published, and I had also at my service vast material from many sources, especially the collection in the Copenhagen Museum, together with the large collections procured, respectively, by the Prince of Monaco in the North Atlantic, by the Swedish Antarctic Expedition, by Dr. Alexander Agassiz during his cruise on the *Albatross* in the tropical east Pacific Ocean in 1904-1905, etc.; but the fauna of the north Pacific with Bering Sea was nearly unknown, and the material collected by the *Albatross*, the *Grampus*, etc., in the Atlantic off the United States had never been worked out. In order to fill such gaps in our knowledge of the world's fauna I applied to the authorities of the United States National Museum, who most kindly lent me for investigation its entire material. It contains several interesting Pacific forms, among which are a new genus, two new species unknown to me from any other collection, good material of two rare and hitherto imperfectly known species, etc. In the preliminary paper mentioned I established the new genus and species and added observations on some other forms. But the rich collection, which at present fills about 600 vials and bottles and comprises 46 species, deserves to be dealt with in a separate paper, containing descriptions with figures of sev-

¹Since the author completed this paper and transmitted it to the United States National Museum there have been published three papers dealing with the Euphausiacea which add considerably to our knowledge of their distribution. They are as follows: W. M. TATTERSALL, The Schizopoda, Stomatopoda and nonantarctic Isopoda of the Scottish National Antarctic Expedition (Trans. Roy. Soc. Edinburgh, vol. 49, pt. 4, 1913. CARL ZIMMER, Die Schizopoden der Deutschen Südpolar Expedition, 1901-1903, (Deutsche Südpolar Expedition, 1901-1903, vol. 15, Zoologie, 7, 1914). CALVIN O. ESTERLY, The Schizopoda of the San Diego region (Univ. of California Publ., vol. 13, No. 1, April 14, 1914). The present author regrets that he has not been able to take these papers into consideration in his treatment of the topic "Distribution" under the various species here discussed.

²Bull. l'Inst. Océan. Monaco, No. 210.

eral forms, enumeration of the localities for every species, etc. In the present paper that task is attempted.

In most cases it has been deemed unnecessary to give a full account of the synonymy, because in papers published in 1908–1913 I have dealt with this topic for the major part of the species, but I always refer to one or two of the best descriptions and illustrations of the form in question. At each species all localities are enumerated, and generally they are arranged according to latitude, but localities in the Pacific are, of course, kept separately from those in the Atlantic. It may be added that I have also had for inspection the material worked out by Ortmann in 1894¹ and in 1905², and the localities for these animals are mentioned separately after the other stations from the Pacific under the species in question.

For some species which do not occur near the surface I have at each station added the depth of the sea, though the animals, at least generally, inhabit intermediate layers. For some species which frequently live at the surface I have noted the surface temperature at every locality, and when the animals have been caught at the surface I have generally noted not only the temperature but also the hour, etc.

As to the localities it may be said here that all marked "Sta." belong to the United States Bureau of Fisheries, and of these all numbers after Station 2000 are *Albatross* stations. The places marked "Hyd." or "Sur." are separate kinds of *Albatross* localities.

Genus BENTHEUPHAUSIA G. O. Sars.

Of this most interesting genus only a single species is known.

1. BENTHEUPHAUSIA AMBLYOPS G. O. Sars (1883).

1885. *Bentheuphausia amblyops* G. O. Sars, *Challenger* Rep., vol. 13, p. 109, pl. 19, text-fig. 4.

Occurrence.—This species has been taken at two stations in the northwestern Atlantic:

Sta. 2044. July 31, 1883. Lat. 40° 00' 30'' N.; long. 68° 37' 20'' W. 1,067 fathoms. 1 small specimen.

Sta. 2099. October 2, 1883. Lat. 37° 12' 30'' N.; long. 69° 39' W. 2,949 fathoms. 1 full-grown specimen.

Distribution.—The very wide distribution of this deep-sea form has been given in my Harvard paper.³

Genus THYSANOPODA Milne Edwards.

This genus comprises 11 species, 6 of which are represented in the collection. As to the grouping of the species I refer to my Harvard work.

¹ Bull. Mus. Comp. Zool., vol. 25, No. 8.

² Bull. U. S. Comm. Fish and Fisheries for 1903, pt. 3.

³ Mem. Mus. Comp. Zool., vol. 30, No. 4, 1912, p. 207.

2. THYSANOPODA MONACANTHA Ortmann (1893).

1910. *Thysanopoda agassizii* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 87, pl. 13, figs. 3a-3g (with synonymy).

1912. *Thysanopoda monacantha* H. J. HANSEN, *Mem. Mus. Comp. Zool.*, vol. 35, No. 4, p. 212, pl. 4, figs. 3a-3c.

Occurrence.—Taken in the western Atlantic at three stations:

Sta. 2667. May 5, 1886. Lat. $30^{\circ} 53' N.$; long. $79^{\circ} 42' 30'' W.$ 273 fathoms. 1 specimen.

Sta. 2665. May 4, 1886. Lat. $29^{\circ} 47' N.$; long. $80^{\circ} 05' 45'' W.$ 263 fathoms. 1 specimen.

Sta. 2151. April 10, 1884. Caribbean Sea. Lat. $15^{\circ} 28' 39'' N.$; long. $80^{\circ} 36' W.$ 653 fathoms. 1 specimen.

In 1894 Ortmann mentioned specimens from the two following stations in the Pacific and referred them to his *Thysanopoda agassizii*, new species, which is synonymous with *T. monacantha*:

Sta. 3414. April 8, 1891. Off Mexico. Lat. $10^{\circ} 14' N.$; long. $96^{\circ} 28' W.$ 200-0 fathoms. 1 specimen.

Sta. 3382. March 7, 1891. Off Panama. Lat. $6^{\circ} 21' N.$; long. $80^{\circ} 41' W.$ 200 fathoms; closed part of the Tanner net. 1 specimen.

In 1905 Ortmann recorded a specimen from the Hawaiian Islands at the following locality:

Sta. 3804. March 21, 1902. Lat. $24^{\circ} 58' 42'' N.$; long. $149^{\circ} 11' W.$ 50-0 fathoms. 1 specimen.

The collection in hand contains a specimen from each of the two first-named stations: 3414 and 3382, but no specimen from Station 3804, and for the following reason some error must have crept in. The specimen marked "type" is from Station 3414 and measures 30 mm. from the tip of the rostrum to the end of the telson, while Ortmann gives the length of his type to be 19 mm. But in his paper on the Schizopoda from the Hawaiian Islands Ortmann says the specimen in question (from Station 3804) is 32 mm.; consequently I suppose that in one way or another this specimen has in America been put with the label indicating Station 3414, and that the much smaller specimen from this station has been lost. This is the only explanation I can give.

Distribution.—The wide distribution has been given in my Harvard paper quoted. Tattersall enumerated a number of stations in the Indian Ocean in 1912.¹

3. THYSANOPODA ÆQUALIS H. J. Hansen (1905).

1910. *Thysanopoda æqualis* H. J. HANSEN, *Siboga-Exp.*, vol. 37, p. 84, pl. 12, figs. 4a-4c; pl. 13, fig. 1a.

Occurrence.—Taken in the northwestern Atlantic at a single station by the *Albatross*:

Sta. 2224. September 8, 1884. Lat. $36^{\circ} 16' 30'' N.$; long. $18^{\circ} 21' W.$ 1 specimen.

¹ Trans. Linn. Soc. London, ser. 2, vol. 15, pt. 1, p. 129.

Furthermore, the collection contains a specimen from the South Pacific:

Lat. 33° S.; long. $120^{\circ} 57'$ W. U. S. S. *Wachusett*, July 24, 1888. Dr. W. H. Jones, United States Navy.

Finally, the *Albatross* has taken the species at the Hawaiian Islands: Sta. 3808. March 23, 1902. Lat. $22^{\circ} 10'$ N.; long. $155^{\circ} 35' 45''$ W. 50-0 fathoms. 9 specimens.

The tube, with these nine specimens, contains the original label of the *Albatross*, and, according to another label, Ortmann determined the animals as *T. obtusifrons* G. O. Sars; that they do not belong to the last-named species, but to *T. æqualis* H. J. Hansen, may easily be seen from the shape of the lobe on the first antennular joint; but in the paper on the Hawaiian Schizopods Ortmann wrote that he had seen five specimens of *T. obtusifrons* from station 3806 and 13 specimens from station 3888. The latitude and longitude given for the last-named station show that 3888 is a misprint for 3808; the animals from station 3806 are not in the collection.

Distribution.—This species is widely distributed in the Atlantic, the Indian, and the Pacific Oceans, as shown in my Harvard paper;¹ a goodly number of localities in the Indian Ocean are enumerated by Tattersall in 1912.²

4. THYSANOPODA PECTINATA Ortmann (1893).

1912. *Thysanopoda pectinata* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 218, pl. 5, figs. 1a-1m (with synonymy).

Occurrence.—The *Albatross* has taken a single specimen in the Gulf of Mexico:

Sta. 2393. March 13, 1885. Lat. $28^{\circ} 43'$ N.; long. $87^{\circ} 14' 30''$ W. 525 fathoms. 1 specimen.

The specimen is a fine male measuring 39 mm. in length.

Distribution.—It has been given in the Harvard work. According to Tattersall (in 1912), it has also been taken at two stations in the Indian Ocean.

5. THYSANOPODA ACUTIFRONS Holt and Tattersall (1905).

1906. *Thysanopoda acutifrons* HOLT and TATTERSALL, Fisheries, Ireland, Sci. Invest., 1904, vol. 5, p. 8, pl. 1.

1910. *Thysanopoda acutifrons* H. J. HANSEN, *Siboga-Exp.*, vol. 37, pp. 85-86, text-figure.

Occurrence.—This large species has been taken at no less than 24 stations in the northwestern Atlantic by the steamers *Fish Hawk* and *Albatross*:

Sta. 2428. June 23, 1885. Lat. $42^{\circ} 48'$ N.; long. $50^{\circ} 55' 30''$ W. 826 fathoms. 7 specimens (6 females, 1 male).

Sta. 2427. June 23, 1885. Lat. $42^{\circ} 46'$ N.; long. $51^{\circ} 00'$ W. 523 fathoms. 4 specimens (3 females, 1 male).

¹ Pp. 214-215.

² Trans. Linn. Soc. London, ser. 2, vol. 15, pt. 1, p. 128.

- Sta. 2076. September 4, 1883. Lat. $41^{\circ} 13' N.$; long. $66^{\circ} 00' 50'' W.$ 906 fathoms. 4 specimens (3 females, 1 male).
- Sta. 2083. September 5, 1883. Lat. $40^{\circ} 26' 40'' N.$; long. $67^{\circ} 05' 15'' W.$ 950 fathoms. 3 specimens (females).
- Sta. 2045. July 31, 1883. Lat. $40^{\circ} 04' 20'' N.$; long. $68^{\circ} 43' 50'' W.$ 373 fathoms. 1 specimen (female).
- Sta. 2047. July 31, 1883. Lat. $40^{\circ} 02' 30'' N.$; long. $68^{\circ} 49' 40'' W.$ 389 fathoms. 1 young specimen.
- Sta. 2044. July 31, 1883. Lat. $40^{\circ} 00' 30'' N.$; long. $68^{\circ} 37' 20'' W.$ 1,067 fathoms. 1 young specimen, with the eyes divided.
- Sta. 1096. August 11, 1881. Lat. $39^{\circ} 53' N.$; long. $69^{\circ} 47' W.$ 317 fathoms. 1 young specimen, with the eyes divided.
- Sta. 953. August 23, 1880. Lat. $39^{\circ} 52' 30'' N.$; long. $70^{\circ} 17' 30'' W.$ 724 fathoms. 2 specimens (male, female).
- Sta. 937. August 4, 1880. Lat. $39^{\circ} 49' 25'' N.$; long. $69^{\circ} 49' W.$ 606 fathoms. 1 specimen (female).
- Sta. 936. August 4, 1880. Lat. $39^{\circ} 46' 30'' N.$; long. $69^{\circ} 47' W.$ 716 fathoms. 1 specimen (female).
- Sta. 2094. September 21, 1883. Lat. $39^{\circ} 44' 30'' N.$; long. $71^{\circ} 04' W.$ 1,022 fathoms. 2 specimens (male, female).
- Sta. 2093. September 21, 1883. Lat. $39^{\circ} 42' 50'' N.$; long. $71^{\circ} 01' 20'' W.$ 1,000 fathoms. 1 specimen (female).
- Sta. 2095. September 30, 1883. Lat. $39^{\circ} 29' N.$; long. $70^{\circ} 58' 40'' W.$ 1,342 fathoms. 2 specimens (females).
- Sta. 2101. October 3, 1883. Lat. $39^{\circ} 18' 30'' N.$; long. $68^{\circ} 24' W.$ 1,686 fathoms. 1 specimen (female).
- Sta. 2235. September 13, 1884. Lat. $39^{\circ} 12' N.$; long. $72^{\circ} 03' 30'' W.$ 707 fathoms. 1 specimen (female).
- Sta. 2104. November 5, 1883. Lat. $38^{\circ} 49' N.$; long. $72^{\circ} 40' 30'' W.$ 991 fathoms. 1 specimen (female).
- Sta. 2715. September 18, 1886. Lat. $38^{\circ} 29' 30'' N.$; long. $70^{\circ} 54' 30'' W.$ 1,753 fathoms. 1 specimen (female).
- Sta. 2039. July 28, 1883. Lat. $38^{\circ} 19' 26'' N.$; long. $68^{\circ} 20' 20'' W.$ 2,369 fathoms. 1 specimen (female).
- Sta. 2565. August 28, 1885. Lat. $38^{\circ} 19' 20'' N.$; long. $60^{\circ} 02' 30'' W.$ 2,069 fathoms. 1 specimen (immature female).
- Sta. 2105. November 6, 1883. Lat. $37^{\circ} 50' N.$; long. $73^{\circ} 03' 50'' W.$ 1,395 fathoms. 1 specimen (female).
- Sta. 2223. September 7, 1884. Lat. $37^{\circ} 48' 30'' N.$; long. $69^{\circ} 43' 30'' W.$ 2,516 fathoms. 1 specimen (female).
- Sta. 2098. October 1, 1883. Lat. $37^{\circ} 40' 30'' N.$; long. $70^{\circ} 37' 30'' W.$ 2,221 fathoms. 2 specimens (females).
- Sta. 2099. October 2, 1883. Lat. $37^{\circ} 12' 30'' N.$; long. $69^{\circ} 39' W.$ 2,949 fathoms. 1 specimen (female).

Remarks.—In several among the full-grown specimens the eyes are darker than in those taken by the Prince of Monaco, the *Ingolf*, or the

Thor; but this darker color may perhaps be due to the preservation. In most of the males the distal curved part of the terminal process of the male copulatory organs is extremely acute and even a little longer, more slender, and more curved than in the specimen figured in the *Siboga* work.

Some of the specimens are uncommonly large. A female from Station 2094 measures 47 mm., a female from Station 2095, 48.5 mm., from the end of the rostrum to the tip of the telson. A male from Station 2094 is 30 mm. long, another, from Station 2427, is 38 mm., and a third male, from Station 2428, is 41 mm.

Distribution.—According to the statements in my *Ingolf* Malacostraca¹ (which also gives the synonymy) this species has a rather restricted distribution; quite recently K. Stephensen has added several stations from West Greenland. In Davis Strait it goes northward to lat. 63° 49' N. West of Iceland it has been taken northward to lat. 65° 20' N. Besides, it has been taken southwest and south of Iceland, southwest of the Faroes, west of the Hebrides, west and southwest of Ireland, finally west of France southward to lat. 46¼° N. It has never been caught near the surface; as to more detailed information I refer to the *Ingolf* paper. In the list of American stations I have in each case added the depth of the sea, though it may be taken for granted that the animals have always been taken by the instruments between the bottom and the surface.

6. THYSANOPODA ORIENTALIS H. J. Hansen (1910).

1910. *Thysanopoda orientalis* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 85, pl. 13, figs. 2a-2i.

1912. *Thysanopoda orientalis* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 222, pl. 5, figs. 2a-2i.

Occurrence.—Taken in the west Atlantic at three stations:

Sta. 994. September 8, 1881. Lat. 39° 40' N.; long. 71° 30' W. 368 fathoms. 1 specimen (scarcely full-grown female).

Sta. 2665. May 4, 1886. Lat. 29° 47' N.; long. 80° 05' 45'' W. 263 fathoms. 1 specimen (female).

Sta. 2382. March 3, 1885. Lat. 28° 19' 45'' N.; long. 88° 01' 30'' W. 1,255 fathoms. 1 specimen (female).

Furthermore, the *Albatross* has taken this species at two stations in the Eastern Chinese Sea, not far from southern Japan:

Sta. 4908. August 11, 1906. Lat. 31° 40' N.; long. 129° 20' 40'' E. 434 fathoms. 1 specimen (female).

Sta. 4905. August 11, 1906. Lat. 31° 39' N.; long. 129° 19' E. 369 fathoms. 1 specimen (male).

Remarks.—This species is closely allied to *T. acutifrons*; the differences have been pointed out in the two papers quoted above. The males of the two species are easily separated by the copulatory

organs, but females, especially not quite full-grown specimens, may sometimes be difficult to separate with certainty, though the shape of the lobe of the first antennular joint generally affords a good character. The single male has the processes of the copulatory organs agreeing with my figure in the Harvard work; this specimen measures about 33 mm. and is a little smaller than the female Chinese specimen, which is 35 mm. long. That the two Atlantic females secured, respectively, in the Gulf of Mexico (Station 2382) and off the northern part of Florida (Station 2665) belong to *T. orientalis* is quite certain, but according to the color of the eyes, the shape of the lobe of the first antennular joint and the fourth abdominal segment feebly produced at the dorsal line I must refer the subadult female from Station 994 to *T. orientalis*, though it has been taken so far northward in the area occupied by *T. acutifrons*.

Distribution.—This species had been captured in the tropical East Pacific south of the line, in the Indian Archipelago, and by the Prince of Monaco in the North Atlantic west of southern Spain. The distribution is thus very different from that of *T. acutifrons*.

7. THYSANOPODA CORNUTA Illig (1905).

Plate 1, fig. 1a.

1905, March 28. *Thysanopoda cornuta* ILLIG, Zool. Anz., vol. 28, p. 663 (with three text-figures).

1905, April 1. *Thysanopoda insignis* H. J. HANSEN, Bull. Mus. Océan. Monaco, No. 30, p. 19 (with three text-figures).

Occurrence.—The *Albatross* has captured this gigantic species at two stations, one in the Northwest Atlantic, the other in the Pacific at southern Japan.

Sta. 2717. September 18, 1886. Lat. $38^{\circ} 24' N.$; long. $71^{\circ} 13' W.$ 1,615 fathoms. 1 specimen.

Sta. 4953. August 22, 1906. Lat. $31^{\circ} 39' N.$; long. $132^{\circ} 54' 40'' E.$ 1,350 fathoms. 1 specimen.

Remarks.—Both specimens are females; the Atlantic specimen measures 60 mm., that from the west Pacific 79 mm. from the front margin of the carapace to the end of the telson. To the description in my paper quoted, a few remarks may be added.

The narrow longitudinal strip near most of the lower lateral margin of the carapace is thickened as a conspicuous ridge (fig. 1a); considerably above this ridge another ridge runs subparallel with the lower margin, but the last-named ridge is only half as long as the carapace, disappearing at some distance from the hind margin, and very far from the front margin of the carapace. This description conveys a more correct idea of the structure than my earlier mention of two longitudinal furrows, which seem to be found, one a little above the lower margin, consequently at the upper margin of the lower ridge, and the other just below the upper lateral ridge.

Figure 1a may, for the rest, convey a fair idea of the furrows and ridges of the carapace.

Distribution.—Three localities are mentioned in the literature. The species has been taken twice in the East Atlantic, that is, in its tropical area by the German Deep-Sea Expedition and in the subtropical northern part by the Prince of Monaco; finally it was secured by Dr. A. Agassiz in the tropical East Pacific.

(?) *THYSANOPODA CORNUTA* Illig. (Young).

Under this name I described and figured in the Harvard paper¹ an animal near the end of the larval life and measuring 14.5 mm. in length. The *Albatross* has gathered a specimen at the following station in the Pacific:

Sta. 4759. May 20, 1906. Lat. 53° 05' N.; long. 138° 31' W. 300–0 fathoms. 1 specimen.

This specimen, which also is 14.5 mm. long, differs from that figured in 1912 in having a fine, slender rostrum which is about one-third as long as the front margin of the frontal plate; furthermore, the median anterior keel on the carapace is feebly developed, the furrows and keels on the carapace and on the posterior abdominal segments are feeble or not discernible, the endopods are still distinctly shorter in proportion to the telson and their exopod considerably shorter than the endopod; finally, the thoracic legs are much less developed than in my former specimen. All these features show that the new specimen, though as long as that described in 1912 and agreeing with it as to the shape of the frontal plate, in general aspect, etc., is somewhat less developed, possessing decidedly more larval features. It may be added that its antennular flagella are similar in length, scarcely half as long as the carapace and somewhat shorter than the antennal flagella.

Genus *MEGANYCTIPHANES* Holt and Tattersall.

Only a single species is known.

8. *MEGANYCTIPHANES NORVEGICA* M. Sars (1856).

1886. *Nyctiphanes norvegica* KOELBEL, Die oesterr. Polarst. Jan Mayen, p. 48, pl. 3, figs. 7–10.

1905. *Meganyctiphanes norvegica* HOLT and TATTERSALL, Rep. Sea and Inland Fisheries of Ireland, 1902–1903, pt. 2, No. 4, pp. 105 and 135, pl. 16.

Other references to literature are found in K. Stephensen's *Grønlands Krebsdyr og Pycnogonider*.² It may be added that I pointed out in the *Siboga* Report (p. 90) that *Euphausia lanei* Holt and Tattersall (1905) had been established on a less than half-grown and besides somewhat damaged specimen of *M. norvegica*.

Occurrence.—It has been captured at a very large number of places in the northwestern area of the Atlantic:

¹ P. 224, pl. 6, figs. 1a–1e.

² Meddelelser om Grønland, vol. 22, 1913.

Grampus No. 638. August 1, 1894. Lat. $50^{\circ} 01' 15''$ N.; long. $65^{\circ} 33' 45''$ W. 1 specimen.

Grampus. July 29, 1894. About lat. $49\frac{1}{2}^{\circ}$ N.; long. $64\frac{1}{3}^{\circ}$ W. Dip net, from well. 10 specimens.

Grampus No. 666. August 5, 1894. Lat. $48^{\circ} 29'$ N.; long. $60^{\circ} 56' 15''$ W. Numerous specimens.

Grampus No. 608. July 28, 1894. Lat. $48^{\circ} 11'$ N.; long. $64^{\circ} 02' 30''$ W. 2 specimens.

Bay of Fundy (about lat. 45° N.), United States Fish Commission, 1872. Numerous specimens.

Eastport Harbor (about lat. $44^{\circ} 54'$ N.). Half pint of specimens.

July 25, 1893. Lubec, Maine (near Eastport), United States Fish Commission. Enormous number of specimens.

September 8, 1878. Banquereau (lat. 44° – 45° N.; about 58° long.). From stomach of Rudder Fish. Schooner *Marion*. 3 specimens.

Grampus No. 809. September 9, 1894. Lat. $44^{\circ} 13' 15''$ N.; long. $67^{\circ} 55' 15''$ W. 1 specimen.

Sta. 105. September 20, 1877. Off Nova Scotia (about lat. 44° N.; long. $63\frac{1}{3}^{\circ}$ W.). 1 specimen.

Grampus No. 759. August 24, 1894. Lat. $43^{\circ} 36' 30''$ N.; long. $69^{\circ} 03' 30''$ W. 11 specimens.

Sta. 191–2. August 31, 1878. About lat. $42^{\circ} 33\frac{1}{2}'$ N.; long. 70° W. 3 specimens.

Sta. 184. August 29, 1878. About lat. $42^{\circ} 30\frac{1}{2}'$ N.; long. $70\frac{2}{3}^{\circ}$ W. 3 specimens.

Sta. 234, 238. September 25, 26, 1878. Lat. $42^{\circ} 30\frac{1}{2}'$ N.; long. $70^{\circ} 38'$ W. 8 specimens.

Sta. 194. August 31, 1894. About lat. $42\frac{1}{2}^{\circ}$ N.; long. 70° W. 3 specimens.

Sta. 1078. August 2, 1882. Off Cape Cod (about lat. $42\frac{1}{3}^{\circ}$ N.). 5 specimens.

Sta. 1083. August 2, 1882. Off Cape Cod. 11 specimens.

Grampus No. 480. July 7, 1894. Lat. $42^{\circ} 13' 15''$ N.; long. $70^{\circ} 15' 30''$ W. Many specimens.

Grampus No. 503. July 9, 1894. Lat. $42^{\circ} 13'$ N.; long. $70^{\circ} 24'$ W. 8 specimens.

Grampus. July 9, 1894. Near lat. $42^{\circ} 13'$ N.; long. $70^{\circ} 24'$ W. Dip-net. Half pint.

Grampus. July 9, 1894. With dip-net in the well of the schooner. Numerous specimens.

Grampus No. 481. July 7, 1894. Lat. $42^{\circ} 12' 15''$ N.; long. $70^{\circ} 17' 15''$ W. Dip-net. Large number of specimens.

Grampus No. 482. July 7, 1894. Near the preceding place. Dip-net. Large number of specimens.

Sta. 318. August 29, 1879. Lat. $42^{\circ} 01\frac{1}{2}'$ N.; long. $70^{\circ} 15'$ W. 3 specimens.

Sta. 2528. July 13, 1885. Lat. $41^{\circ} 47'$ N.; long. $65^{\circ} 37' 30''$ W. 4 young specimens.

Woods Hole region. About lat. $41^{\circ} 32'$ N. 4 specimens.

Grampus No. 75. May 25, 1891. Lat. $40^{\circ} 22'$ N.; long. $72^{\circ} 38'$ W. Immense number of older larvæ.

Sta. 2045. July 31, 1883. Lat. $40^{\circ} 04' 20''$ N.; long. $68^{\circ} 43' 50''$ W. 1 specimen.

Sta. 2046. July 31, 1883. Lat. $40^{\circ} 02' 49''$ N.; long. $68^{\circ} 49'$ W. 1 specimen.

Sta. 2025. May 25, 1883. Lat. $40^{\circ} 02'$ N.; long. $70^{\circ} 27'$ W. 1 specimen.

Sta. 2091. September 21, 1883. Lat. $40^{\circ} 01' 50''$ N.; long. $70^{\circ} 59'$ W. 1 specimen.

Sta. 1092. August 11, 1882. Lat. $39^{\circ} 58'$ N.; long. $69^{\circ} 42'$ W. 4 specimens.

Sta. 1029. September 14, 1881. Lat. $39^{\circ} 57' 06''$ N.; long. $68^{\circ} 16'$ W. 14 specimens.

Sta. 1028. September 14, 1881. Lat. $39^{\circ} 57'$ N.; long. $69^{\circ} 17'$ W. 7 specimens.

Sta. 1031. September 14, 1881. Lat. $39^{\circ} 57'$ N.; long. $69^{\circ} 19'$ W. 1 specimen.

Sta. 1035. September 14, 1881. Lat. $39^{\circ} 57'$ N.; long. $69^{\circ} 28'$ W. 6 specimens.

Sta. 1094. August 11, 1882. Lat. $39^{\circ} 57'$ N.; long. $69^{\circ} 47'$ W. 2 specimens.

Sta. 1032. September 14, 1881. Lat. $39^{\circ} 56'$ N.; long. $69^{\circ} 22'$ W. 3 specimens.

Sta. 1033. September 14, 1881. Lat. $39^{\circ} 56'$ N.; long. $69^{\circ} 24'$ W. 8 specimens.

Sta. 1034. September 14, 1881. Lat. $39^{\circ} 56'$ N.; long. $69^{\circ} 26'$ W. 11 specimens.

Sta. 946. August 9, 1881. Lat. $39^{\circ} 55\frac{1}{2}'$ N.; long. $71^{\circ} 14'$ W. 3 specimens.

Sta. 2188. August 3, 1884. Lat. $39^{\circ} 54' 30''$ N.; long. $71^{\circ} 08'$ W. 3 specimens.

Sta. 1096. August 11, 1882. Lat. $39^{\circ} 53'$ N.; long. $69^{\circ} 47'$ W. 1 specimen.

Sta. 939. August 4, 1881. Lat. $39^{\circ} 53'$ N.; long. $69^{\circ} 50' 30''$ W. 2 specimens.

Sta. 1026. September 8, 1881. Lat. $39^{\circ} 50' 30''$ N.; long. $71^{\circ} 23'$ W. 8 specimens.

Grampus No. 235. May 15, 1894. Lat. $39^{\circ} 50' 30''$ N.; long. $71^{\circ} 17' 45''$ W. 2 specimens.

Sta. 2582. September 18, 1885. Lat. $39^{\circ} 50' 00''$ N.; long. $71^{\circ} 43' W.$ 1 specimen.

Sta. 879. September 13, 1880. Lat. $39^{\circ} 49' 30''$ N.; long. $70^{\circ} 54' W.$ 1 specimen.

Sta. 2215. August 22, 1884. Lat. $39^{\circ} 49' 15''$ N.; long. $70^{\circ} 31' 45'' W.$ 2 specimens.

Sta. 880. September 13, 1880. Lat. $39^{\circ} 48' 30''$ N.; long. $70^{\circ} 54' W.$ 5 specimens.

Sta. 2192. August 5, 1884. Lat. $39^{\circ} 46' 30''$ N.; long. $70^{\circ} 14' 45'' W.$ 1 specimen.

Sta. 2029. May 25, 1883. Lat. $39^{\circ} 42' N.$; long. $70^{\circ} 47' W.$ Surface. 1 young specimen.

Sta. 1137. September 8, 1882. Lat. $39^{\circ} 40' N.$; long. $71^{\circ} 52' W.$ 2 specimens.

Sta. 2179. July 23, 1884. Lat. $39^{\circ} 30' 10''$ N.; long. $71^{\circ} 50' W.$ 2 specimens.

Sta. 2180. July 23, 1884. Lat. $39^{\circ} 29' 50''$ N.; long. $71^{\circ} 49' 30'' W.$ 2 specimens.

Grampus No. 232. May 14, 1894. Lat. $39^{\circ} 26' 15''$ N.; long. $71^{\circ} 31' W.$ 5 young specimens.

Sta. 2236. September 13, 1884. Lat. $39^{\circ} 11' N.$; long. $72^{\circ} 08' 30'' W.$ 2 specimens.

Sta. 1044. October 20, 1881. Lat. $38^{\circ} 37' N.$; long. $73^{\circ} 12' W.$ 4 specimens.

Grampus No. 18. May 12, 1887. Lat. $38^{\circ} 30' N.$; long. $74^{\circ} 02' W.$ 12 half-grown specimens.

Sta. 2230. September 12, 1884. Lat. $38^{\circ} 27' N.$; long. $73^{\circ} 02' W.$ 1 young specimen.

Grampus No. 29. April 27, 1887. Lat. $37^{\circ} 43' N.$; long. $74^{\circ} 15' W.$ 1 young specimen.

Sta. 897. November 16, 1880. Lat. $37^{\circ} 25' N.$; long. $74^{\circ} 18' W.$ 2 specimens.

All gatherings undertaken by the *Grampus* in 1887, 1891, and 1894 are tow-net hauls, consequently the animals secured must have lived near the surface.

Remarks.—One of the largest females from lat. $42^{\circ} 13' 15'' N.$ is 35 mm. long, while a very large male captured off Cape Cod (Station 1083) is even 39.5 mm. long.

Distribution.—The list above shows that in the west Atlantic off North America this species goes southward to lat. $37^{\circ} 25' N.$, off Delaware Bay and northward to the northern part of the Gulf of Lawrence, while it is unknown between the last-named locality and Davis Strait. Quite recently it has been captured at the entrance of Davis Strait, at lat. $60^{\circ} 07' N.$; long. $48^{\circ} 26' W.$ (K. Stephenson). It has been taken west, east, and north of Iceland, near Jan

Mayen and at places near east Greenland, going northward to lat. $74^{\circ} 30' N$. Its occurrence in the western Mediterranean, along the western coasts of Europe to Vadsö and in the Arctic Sea north of Europe and Asia has been dealt with in the *Ingolf* Malacostraca (vol. 1) which also contains more detailed information. Richters's statement, with a query, about its occurrence in Bering Sea is undoubtedly wrong.

Genus NYCTIPHANES G. O. Sars.

The genus comprises four species, but only a single form is represented in the collection.

9. NYCTIPHANES SIMPLEX H. J. Hansen (1911).

1912. *Nyctiphanes simplex* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, pp. 227, 288, pl. 6, figs. 2a-2i (adult and subadult); pl. 7, figs. 1a-1b (young); pl. 12, figs. 3a-3f (larval stages).

Occurrence.—Among the unnamed material, specimens from six stations in the east Pacific are at hand:

Sta. 4399. April 7, 1904. Lat. $32^{\circ} 44' 50'' N$.; long. $117^{\circ} 48' 45'' W$. Surface. Surf. temp. 62° . 4.18 p. m. 4 specimens.

San Luis Gonzales Bay, Gulf of California (about lat. $30^{\circ} N$.; long. $114\frac{1}{2}^{\circ} W$.). March 27, 1889. *Albatross*. Enormous number of specimens.

Sta. 2834. May 3, 1888. Lat. $26^{\circ} 14' N$.; long. $113^{\circ} 13' W$. From stomach of *Merlucius*. Many specimens.

Sur. 16. March 1, 1888. Lat. $4^{\circ} 21' N$.; long. $81^{\circ} 59' W$. Moonlight. Surface. Surf. temp. 74° . 2 specimens.

Sur. 28. April 7, 1888. Off Hood Island, Galapagos Archipelago. Surface. Scoop net, electric light. Clear starlight. 8-9 p. m. Numerous specimens.

Narborough Id., Galapagos. From stomach of *Puffinus*. January 5, 1889. Stanford University. Numerous fine specimens.

Furthermore, the material from seven of the nine stations recorded in 1894 by Ortmann for *Nyctiphanes australis* G. O. Sars belongs to *N. simplex*: (The specimens from the two other stations belong to *Euphausia recurva* H. J. Hansen, and are recorded later on.)

Sur. 542. January 14, 1892. Lat. $35^{\circ} 31' N$.; long. $124^{\circ} 57' 30'' W$. Surface. Surf. temp. 56° . 8 specimens.

Sur. 52. October 13 or 14, 1891. About lat. $35^{\circ} N$.; long. $129^{\circ} W$. Surface. 1 specimen.

Sta. 3435. April 22, 1891. Lat. $26^{\circ} 48' N$.; long. $110^{\circ} 45' 20'' W$. Surface. Surf. temp. 70° . 6 young specimens.

Hyd. 2619. March 11, 1891. Lat. $7^{\circ} 31' N$.; long. $78^{\circ} 42' 30'' W$. 1,000-0 fathoms. 1 specimen.

Sta. 3388. March 9, 1891. Lat. $7^{\circ} 06' N$.; long. $79^{\circ} 48' W$. 400-0 fathoms. 1 specimen.

March 7, 1891, thus near lat. $6^{\circ} 21' N.$; long. $80^{\circ} 41' W.$ 3 specimens.

Sta. 3409. April 3, 1891. Lat. $0^{\circ} 18' 40'' N.$; long. $90^{\circ} 34' W.$ Surface. Surf. temp. 82° . 2 specimens.

Remarks.—Some of the specimens are uncommonly large. A male taken March 7, 1891, measures 13.5 mm. in length; a female, from Narborough Island, is even 16 mm. long, and a male from the same locality, 14 mm.

Distribution.—The species is known only from the east Pacific, between lat. $35^{\circ} 31' N.$ and lat. $5^{\circ} 57\frac{1}{2}' S.$

Genus EUPHAUSIA Dana.

In the revision of the order (1911) I enumerated 27 species and divided them into four groups. Seventeen species are represented in the collection.

10. EUPHAUSIA KROHNII Brandt.

1851. *Thysanopoda krohnii* BRANDT, Krebse, in Middendorff's Sibirische Reise, vol. 2, pt. 1, p. 127.

1863. *Euphausia mülleri* CLAUS, Zeitschr. wiss. zool., vol. 13, p. 444, pls. 28-29, figs. 29-45.

1882. *Thysanopoda bidentata* G. O. SARS, Forh. Vidensk. Selsk. Christiania for 1882, No. 18, p. 50, pl. 1, figs. 11-14.

1911. *Euphausia krohnii* H. J. HANSEN, Bull. l'Inst. Océan. Monaco, No. 210, p. 22, with 2 text-figures.

Occurrence.—This North Atlantic species has been taken at the following places:

Sta. 69. September 1, 1877. Lat. $42^{\circ} 44' N.$; long. $62^{\circ} 43' W.$ Surf. temp. $65\frac{1}{2}^{\circ}$. 2 specimens.

Sta. 2528. July 13, 1885. Lat. $41^{\circ} 47' N.$; long. $65^{\circ} 37' 30'' W.$ Surf. temp. 69° . 6 specimens.

Sta. 2575. September 3, 1885. Lat. $41^{\circ} 07' N.$; long. $65^{\circ} 26' 30'' W.$ Surf. temp. 71° . 1 specimen.

Sta. 2045. July 31, 1883. Lat. $40^{\circ} 04' 20'' N.$; long. $68^{\circ} 43' 50'' W.$ Surf. temp. 72° . 2 specimens.

September 14, 1872. Georges Bank region (lat. 42° – $40^{\circ} N.$; long. 66° – $69^{\circ} W.$). 3 specimens.

Sta. 2047. July 31, 1883. Lat. $40^{\circ} 02' 30'' N.$; long. $68^{\circ} 49' 40'' W.$ Surf. temp. 72° . 2 specimens.

Sta. 1111. August 22, 1882. Lat. $40^{\circ} 01' 33'' N.$; long. $70^{\circ} 35' W.$ Surf. temp. 72° . Numerous specimens.

Sta. 2044. July 31, 1883. Lat. $40^{\circ} 00' 30'' N.$; long. $68^{\circ} 37' 20'' W.$ Surf. temp. 72° . 3 specimens.

Sta. 2213. August 22, 1884. Lat. $39^{\circ} 58' 30'' N.$; long. $70^{\circ} 30' W.$ Surf. temp. 71° . 11 specimens.

Sta. 1114. August 22, 1882. Lat. $39^{\circ} 58' N.$; long. $70^{\circ} 38' W.$ Surf. temp. 72° . 1 specimen.

Sta. 2183. August 2, 1884. Lat. $39^{\circ} 57' 45''$ N.; long. $70^{\circ} 56' 30''$ W. Surf. temp. 68° . 11 specimens.

Sta. 1031. September 14, 1881. Lat. $39^{\circ} 57' 45''$ N.; long. $69^{\circ} 19' 45''$ W. Surf. temp. 65° . 5 specimens.

Sta. 1034. September 14, 1881. Lat. $39^{\circ} 57' 45''$ N.; long. $69^{\circ} 26' 45''$ W. Surf. temp. 62° . 8 specimens.

Sta. 1035. September 14, 1881. Lat. $39^{\circ} 57' 45''$ N.; long. $69^{\circ} 28' 45''$ W. Surf. temp. 62° . 1 specimen.

Sta. 1093. August 11, 1882. Lat. $39^{\circ} 56' 45''$ N.; long. $69^{\circ} 45' 45''$ W. Surf. temp. 75° . 5 specimens.

Sta. 952. August 23, 1881. Lat. $39^{\circ} 55' 45''$ N.; long. $70^{\circ} 28' 45''$ W. Surf. temp. 68° . 3 specimens.

Sta. 2188. August 3, 1884. Lat. $39^{\circ} 54' 30''$ N.; long. $71^{\circ} 08' 45''$ W. Surf. temp. 70° . 13 specimens.

Sta. 1096. August 11, 1882. Lat. $39^{\circ} 53' 45''$ N.; long. $69^{\circ} 47' 45''$ W. Surf. temp. $75\frac{1}{2}^{\circ}$. Numerous specimens.

Sta. 1026. September 8, 1881. Lat. $39^{\circ} 50' 30''$ N.; long. $71^{\circ} 23' 45''$ W. Surf. temp. 69° . 7 specimens.

Sta. 2187. August 3, 1884. Lat. $39^{\circ} 49' 30''$ N.; long. $71^{\circ} 10' 45''$ W. Surf. temp. 68° . 16 specimens.

Sta. 2215. August 22, 1884. Lat. $39^{\circ} 49' 15''$ N.; long. $70^{\circ} 31' 45''$ W. Surf. temp. 74° . Many specimens.

Sta. 2192. August 5, 1884. Lat. $39^{\circ} 46' 30''$ N.; long. $70^{\circ} 14' 15''$ W. Surf. temp. 72° . 14 specimens.

Sta. 2219. August 23, 1884. Lat. $39^{\circ} 46' 22''$ N.; long. $69^{\circ} 29' 45''$ W. Surf. temp. 74° . 3 specimens.

Sta. 2687. July 18, 1886. Lat. $39^{\circ} 46' 45''$ N.; long. $71^{\circ} 19' 45''$ W. 5 specimens.

Sta. 2550. August 9, 1885. Lat. $39^{\circ} 44' 30''$ N.; long. $70^{\circ} 30' 45''$ W. Surf. temp. 76° . 7 specimens.

Sta. 2195. August 5, 1884. Lat. $39^{\circ} 44' 45''$ N.; long. $70^{\circ} 03' 45''$ W. Surf. temp. 74° . 9 specimens.

Sta. 998. September 8, 1881. Lat. $39^{\circ} 43' 45''$ N.; long. $71^{\circ} 32' 45''$ W. Surf. temp. 68° . 1 specimen.

Sta. 997. September 8, 1881. Lat. $39^{\circ} 42' 45''$ N.; long. $71^{\circ} 32' 45''$ W. Surf. temp. 67.5° . 1 specimen.

Sta. 2190. August 4, 1884. Lat. $39^{\circ} 40' 45''$ N.; long. $70^{\circ} 20' 15''$ W. Surf. temp. 73° . Numerous specimens.

Sta. 1137. September 8, 1882. Lat. $39^{\circ} 40' 45''$ N.; long. $71^{\circ} 52' 45''$ W. Surf. temp. 70° . Numerous specimens.

Sta. 2201. August 19, 1884. Lat. $39^{\circ} 39' 45''$ N.; long. $71^{\circ} 35' 15''$ W. Surf. temp. 66° . 13 specimens.

Sta. 2202. August 19, 1884. Lat. $39^{\circ} 38' 45''$ N.; long. $71^{\circ} 39' 45''$ W. Surf. temp. 67° . 11 specimens.

- Sta. 1139. September 8, 1882. Lat. $39^{\circ} 37' N.$; long. $71^{\circ} 55' W.$
Surf. temp. 72° . 1 specimen.
- Sta. 2205. August 30, 1884. Lat. $39^{\circ} 35' N.$; long. $71^{\circ} 18' 45'' W.$
Surf. temp. 73° . 5 specimens.
- Sta. 2203. August 19, 1884. Lat. $39^{\circ} 34' 15'' N.$; long. $71^{\circ} 41' 15'' W.$ Surf. temp. 74° . 7 specimens.
- Sta. 2042. July 30, 1883. Lat. $39^{\circ} 33' N.$; long. $68^{\circ} 26' 45'' W.$
Surf. temp. 71° . 1 specimen.
- Sta. 2683. July 17, 1886. Lat. $39^{\circ} 33' N.$; long. $70^{\circ} 50' W.$ 17 specimens.
- Sta. 1142. September 8, 1882. Lat. $39^{\circ} 32' N.$; long. $72^{\circ} 00' W.$
Surf. temp. 74° . 1 specimen.
- Sta. 1144. September 8, 1882. Lat. $39^{\circ} 31' N.$; long. $72^{\circ} 06' W.$
Surf. temp. 74° . 1 specimen.
- Sta. 2179. July 23, 1884. Lat. $39^{\circ} 30' 10'' N.$; long. $71^{\circ} 50' W.$
Surf. temp. 67° . 3 specimens.
- Sta. 2180. July 23, 1884. Lat. $39^{\circ} 29' 50'' N.$; long. $71^{\circ} 49' 30'' W.$ Surf. temp. 68° . 24 specimens.
- Sta. 2095. September 30, 1883. Lat. $39^{\circ} 29' N.$; long. $70^{\circ} 58' 40'' W.$ Surface. Surf. temp. $69\frac{1}{2}^{\circ}$. 3 specimens.
- Sta. 2178. July 22, 1884. Lat. $39^{\circ} 29' N.$; long. $72^{\circ} 05' 15'' W.$
Surf. temp. 68° . 4 specimens.
- Grampus* No. 232. May 14, 1894. Lat. $39^{\circ} 26' 15'' N.$; long. $71^{\circ} 31' W.$ Tow-net. 6 specimens.
- Sta. 2235. September 13, 1884. Lat. $39^{\circ} 12' N.$; long. $72^{\circ} 03' 30'' W.$ Surf. temp. 72° . Many specimens.
- Sta. 2222. September 6, 1884. Lat. $39^{\circ} 03' 15'' N.$; long. $70^{\circ} 50' 45'' W.$ Surf. temp. 73° . 1 specimen.
- Sta. 2104. November 5, 1883. Lat. $38^{\circ} 48' N.$; long. $72^{\circ} 40' 30'' W.$ Surf. temp. 63° . 1 specimen.
- Sta. 2746. September 18, 1887. Lat. $38^{\circ} 46' N.$; long. $73^{\circ} 05' 45'' W.$ Surf. temp. 68° . 6 specimens.
- Sta. 2102. November 5, 1883. Lat. $38^{\circ} 44' N.$; long. $72^{\circ} 38' W.$ Surface. Surf. temp. $62\frac{1}{2}^{\circ}$. 1 specimen.
- Sta. 1044. October 10, 1881. Lat. $38^{\circ} 37' N.$; long. $73^{\circ} 12' W.$ Surf. temp. 66° . 4 specimens.
- Sta. 2230. September 12, 1884. Lat. $38^{\circ} 27' N.$; long. $73^{\circ} 02' W.$ Surf. temp. 75° . Many specimens.
- Sta. 2565. August 28, 1885. Lat. $38^{\circ} 19' 20'' N.$; long. $60^{\circ} 02' 30'' W.$ Surf. temp. 77° . 2 specimens.
- Grampus* No. 47. May 19, 1891. Lat. $38^{\circ} 09' N.$; long. $74^{\circ} 07' W.$ Immense number of young specimens.
- Sta. 2172. July 20, 1884. Lat. $38^{\circ} 01' 15'' N.$; long. $73^{\circ} 44' W.$ Surf. temp. 76° . 6 specimens.

Sta. 2173. July 21, 1884. Lat. $37^{\circ} 57' N.$; long. $72^{\circ} 34' W.$ Surf. temp. 71° . 4 specimens.

Sta. 2105. November 6, 1883. Lat. $37^{\circ} 50' N.$; long. $73^{\circ} 03' 50'' W.$ Surface. Surf. temp. 63° . 3 specimens.

Sta. 2742. September 17, 1887. Lat. $37^{\circ} 46' 30'' N.$; long. $73^{\circ} 56' 30'' W.$ Surf. temp. 69° . Many specimens.

Sta. 2098. October 1, 1883. Lat. $37^{\circ} 40' 30'' N.$; long. $70^{\circ} 37' 30'' W.$ Surf. temp. $72\frac{1}{2}^{\circ}$. 20 specimens.

Sta. 2229. September 11, 1884. Lat. $37^{\circ} 38' 40'' N.$; long. $73^{\circ} 16' 30'' W.$ Surf. temp. 75° . 8 specimens.

Sta. 2426. June 4, 1885. Lat. $36^{\circ} 01' 30'' N.$; long. $74^{\circ} 47' 30'' W.$ Surf. temp. 71° . 2 specimens.

This extremely long list shows that this species is very common in the West Atlantic off the United States between lat. 40° and $38^{\circ} N.$, going north to about lat. $42\frac{3}{4}^{\circ} N.$ and southward to near lat. $36^{\circ} N.$ Besides, the collection contains a specimen from the Gulf of Gascogne (Exped. *Caudan*) and determined as *Euphausia pellucida* Dana.

The temperature at the surface is noted at each station, because this species, according to my experience from other sources, frequently lives near the surface. It is larger than the following form, and its most important characters have been pointed out in the Monaco paper quoted.

Distribution.—*E. krohnii* is known from the western half of the Mediterranean and besides it is common in the east Atlantic, going southward at least to lat. $36^{\circ} 13' N.$ and northward to lat. $51^{\circ} N.$; a single specimen has been taken on the west coast of Norway.

11. *EUPHAUSIA AMERICANA* H. J. Hansen (1911).

1911. *Euphausia americana* H. J. HANSEN, Bull. l'Inst. Océan. Monaco, No. 210, p. 23, fig. 6.

Occurrence.—Taken by the *Albatross* at six stations in the West Atlantic:

Sta. 2195. August 5, 1884. Lat. $39^{\circ} 44' N.$; long. $70^{\circ} 03' W.$ Surf. temp. 74° . 1 specimen.

Sta. 2569. August 31, 1885. Lat. $39^{\circ} 26' N.$; long. $68^{\circ} 03' 30'' W.$ Surface. Surf. temp. 75° . Numerous specimens.

Sta. 2585. September 19, 1885. Lat. $39^{\circ} 08' 30'' N.$; long. $72^{\circ} 17' W.$ Surf. temp. 73° . 1 specimen.

Sta. 2174. July 21, 1884. Lat. $38^{\circ} 15' N.$; long. $72^{\circ} 03' W.$ Surf. temp. 76° . 15 specimens.

Hyd. 138. February 9, 1884. Caribbean Sea. Lat. $10^{\circ} 51' 30'' N.$; long. $67^{\circ} 01' 40'' W.$ Surface. 11 specimens.

Remarks.—While dealing with the large material of *Euphausia krohnii* in the collection of the United States National Museum I examined the male copulatory organs of specimens of various sizes

and was surprised to find that some smaller specimens which I had deemed to be casual or local varieties, had the two main processes of the copulatory organs quite different from those in large, typical specimens. The result was that the smaller but adult specimens proved to be a species hitherto overlooked, and I named it *E. americana*, because the first specimens observed had been taken off the United States and belong to the National Museum. In the above-quoted paper I pointed out the most important specific characters of the three species with the margin of the lobe of first antennular joint pectinate, viz, *E. krohnii* Brandt, *E. americana*, and *E. eximia* H. J. Hansen; in a future work on the Monaco collection a more detailed description with a number of figures of the two first-named species will be given.

Distribution.—The localities above show that in the Northwestern Atlantic this species goes northward to about lat. $39\frac{3}{4}^{\circ}$ N., that it was found together with *E. krohnii* between lat. $39\frac{3}{4}^{\circ}$ and $38\frac{1}{4}^{\circ}$ N., and that it has besides been taken in the Caribbean Sea. In the paper on the Schizopoda collected by the Swedish Antarctic Expedition (1913) I showed that this expedition had gathered *E. americana* at no less than 20 places in the line from lat. $33^{\circ} 23' \text{ N.}$; long. $18^{\circ} 39' \text{ W.}$ to lat. $32^{\circ} 15' \text{ S.}$; long. $50^{\circ} 14' \text{ W.}$, furthermore that the Copenhagen Museum possesses it from the middle of the North Atlantic, namely, lat. 33° N. ; long. 47° W.

12. EUPHAUSIA EXIMIA H. J. Hansen (1911).

1912. *Euphausia eximia* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 230, pl. 7, figs. 2a-2g.

Occurrence.—Of the material received in unnamed condition specimens from three *Albatross* stations in the Pacific are at hand:

Sur. 26. April 3, 1888. Lat. $0^{\circ} 30' \text{ S.}$; long. $88^{\circ} 37' 30'' \text{ W.}$ Surface. Light clouds, 7.35 p. m. Surf. temp. 80° . Many specimens.

Sta. 2808. April 4, 1888. Lat. $0^{\circ} 36' 30'' \text{ S.}$; long. $89^{\circ} 19' \text{ W.}$ Surf. temp. 79° . 6 specimens.

Sur. 16. March 1, 1888. Lat. $4^{\circ} 21' \text{ S.}$; long. $81^{\circ} 59' \text{ W.}$ Surface. Moonlight. Surf. temp. 74° . 1 specimen.

Among the animals recorded by Ortmann in 1894 as *E. pellucida* Dana the following specimens belong to *E. eximia*:

Off Guaymas (about lat. 28° N. ; long. 111° W.). 500 fathoms. 8 specimens.

Fifty miles south of Guaymas (about lat. $27\frac{1}{4}^{\circ} \text{ N.}$; long. 111° W.). 700-0 fathoms. 1 specimen.

Sta. 3434. April 21, 1891. Lat. $25^{\circ} 29' 30'' \text{ N.}$; long. $109^{\circ} 48' \text{ W.}$ Surface. Surf. temp. 70° . 1 specimen.

Sta. 3416. April 11, 1891. Lat. $16^{\circ} 32' 30'' \text{ N.}$; long. $99^{\circ} 42' 40'' \text{ W.}$ 300-0 fathoms. 4 specimens.

Lat. $13^{\circ} 33' 30''$ N.; long. $97^{\circ} 57' 30''$ W. 8 p. m. Surface. Large number of immature specimens.

Sta. 3414. April 8, 1891. Lat. $10^{\circ} 14'$ N.; long. $96^{\circ} 28'$ W. 200–0 fathoms. Many specimens. 300–0 fathoms. 14 specimens.

Sta. 3388. March 9, 1891. Lat. $7^{\circ} 06'$ N.; long. $79^{\circ} 48'$ W. 400–0 fathoms. 1 specimen.

Sta. 3409. April 3, 1891. Lat. $0^{\circ} 18' 40''$ N.; long. $90^{\circ} 34'$ W. Surface. Surf. temp. 82° . 1 specimen.

Hyd. 2628. March 26, 1891. Lat. $0^{\circ} 13'$ S.; long. $84^{\circ} 52'$ W. 200–0 fathoms. 1 specimen.

Distribution.—This species is known only from the East Pacific, and according to the list above and the long list in the Harvard paper it extends as far north as lat. 28° N. and south to about lat. $14\frac{1}{2}^{\circ}$ S.

13. *EUPHAUSIA DIOMEDEÆ* Ortmann (1894).

1910. *Euphausia diomedæ* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 91, pl. 13, figs. 4a–4e.

1912. *Euphausia diomedæ* H. J. HANSEN, *Mem. Mus. Comp. Zool.*, vol. 35, No. 4, p. 235, pl. 7, fig. 4a.

Occurrence.—Among the unnamed material, specimens were found from two places in the tropical Pacific:

September 9, 1899, *Albatross*, consequently about lat. $2^{\circ} 38'$ N.; long. $137^{\circ} 22'$ W. Surface. 2 specimens.

Sur. 26. April 3, 1888. Lat. $0^{\circ} 30'$ S.; long. $88^{\circ} 37' 30''$ W. Surface. Light clouds, 7.35 p. m. Surf. temp. 80° . 12 specimens.

Among the animals recorded by Ortmann as *E. pellucida* the following specimens belong to *E. diomedæ*.

Sta. 3414. April 8, 1891. Lat. $10^{\circ} 14'$ N.; long. $96^{\circ} 28'$ W. 100–0 fathoms. 3 specimens. About 200 fathoms. 2 specimens.

March 7, 1891, consequently about lat. $6^{\circ} 21'$ N.; long. $80^{\circ} 41'$ W. Surface. 8.30 p. m. Many specimens.

Sta. 3412. April 4, 1891. Lat. $1^{\circ} 23'$ N.; long. $91^{\circ} 43'$ W. Surface. Surf. temp. 82° . Many specimens.

Sta. 3409. April 3, 1891. Lat. $0^{\circ} 18' 40''$ N.; long. $90^{\circ} 34'$ W. Surface. Surf. temp. 82° . 9 specimens.

Remarks.—Ortmann's two type-specimens of *E. diomedæ* were taken at Station 3909. As shown in my papers quoted the characters applied by Ortmann for *E. diomedæ* are in reality founded only on a most remarkable and somewhat anomalous variation. His two specimens were taken together with 9 normal specimens of the same species, but these he referred to *E. pellucida*, which is a mixture of several species well separated by excellent differences in the antennulæ and the copulatory organs.

Distribution.—As pointed out in my Harvard paper (pp. 235–237) this species is known from the Red Sea and is widely distributed in

the tropical areas of both the Indian Ocean and the Pacific, in the East Pacific going northward to lat. $30^{\circ} 35' N$. It has never been taken in the Atlantic.

14. *EUPHAUSIA MUTICA* H. J. Hansen (1905).

1910. *Euphausia mutica* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 93, pl. 14, figs. 1a-1d.

Occurrence.—This species has been taken at a number of places in the northwest Atlantic:

Sta. 1111. August 22, 1882. Lat. $40^{\circ} 01' 33'' N$.; long. $70^{\circ} 35' W$. Surf. temp. 72° . 1 specimen.

Sta. 1137. September 8, 1882. Lat. $39^{\circ} 40' N$.; long. $71^{\circ} 52' W$. Surf. temp. 70° . 1 specimen.

Sta. 2569. August 31, 1885. Lat. $39^{\circ} 26' N$.; long. $68^{\circ} 03' 30'' W$. Surf. temp. 75° . 1 specimen.

Sta. 2585. September 19, 1885. Lat. $39^{\circ} 08' 30'' N$.; long. $72^{\circ} 17' W$. Surface. Surf. temp. 73° . 4 specimens.

Sta. 2742. September 17, 1887. Lat. $37^{\circ} 46' 30'' N$.; long. $73^{\circ} 56' 30'' W$. Surf. temp. 69° . 12 specimens.

Sta. 2098. October 1, 1883. Lat. $37^{\circ} 40' 30'' N$.; long. $70^{\circ} 37' 30'' W$. Surf. temp. $72\frac{1}{2}^{\circ}$. 1 specimen.

Sta. 2224. September 8, 1884. Lat. $36^{\circ} 16' 30'' N$.; long. $68^{\circ} 21' W$. Surf. temp. 79° . 1 specimen.

New Providence Island, Bahamas; *Albatross*. 1 specimen.

Hyd. 138. February 9, 1884. Caribbean Sea: Lat. $10^{\circ} 51' 30'' N$.; long. $67^{\circ} 01' 40'' W$. 8 specimens.

Also 2 specimens were taken by the *Grampus*, July 23, 1890, but the place is unknown.

Furthermore it has been taken in the southeast Pacific at a single place:

August 10, 1884. Lat. $29^{\circ} 33' S$.; long. $81^{\circ} 34' W$. U. S. S. *Wachusett*. Dr. W. H. Jones, U. S. Navy. 6 specimens.

Among the specimens from the Hawaiian Islands referred by Ortmann (1905) to "*E. bidentata* G. O. Sars," several specimens from the following localities belong to *E. mutica*:

Sta. 3829. April 1, 1902. Avalu Point, south coast of Molokai Island. Surface. 1 specimen.

Sta. 3867. April 10, 1902. Pailolo Channel. Surf. temp. 75° . 7 specimens.

Sta. 3901. April 19, 1902. Pailolo Channel. Surface. 7.41 p. m. Surf. temp. 74° . 8 specimens.

Sta. 3912. May 5, 1902. South coast of Oahu Island. Surface. 7.13 p. m. Surf. temp. 76° . 1 specimen.

Sta. 4009. June 17, 1902. Lat. $21^{\circ} 50' 30'' N$.; long. $159^{\circ} 15' W$. Surface. 6.48 p. m. Surf. temp. 76° . Many specimens.

Sta. 4011. June 18, 1902. Lat. $21^{\circ} 20' N.$; long. $158^{\circ} 21' W.$ Surface. 4.03–4.06 p. m. Surf. temp. 77° . 1 specimen.

Distribution.—*E. mutica* is widely distributed in the tropical and temperate areas of the Atlantic, in the Indian Ocean, and in large parts of the tropical and subtropical parts of the Pacific. More special information on this topic is found in my Harvard paper, and in 1912 Tattersall enumerated many places in the Indian Ocean.¹

15. *EUPHAUSIA RECURVA* H. J. Hansen (1905).

1912. *Euphausia recurva* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 233, pl. 7, figs. 3a–3n.

Occurrence.—Among the unnamed material this species was found only from a single locality in the southeast Pacific.

August 10, 1884. Lat. $29^{\circ} 33' S.$; long. $81^{\circ} 34' W.$ U. S. S. *Wachusett*. Dr. W. H. Jones, U. S. Navy. 3 specimens.

Among the specimens referred by Ortmann in 1894 to *Nyctiphanes australis* G. O. Sars those from the two last-named of the four localities mentioned below belong to *E. recurva*, and the same is the case with the specimens referred by him to *E. pellucida*, from the two other stations:

Sur. 543. January 14, 1892. Lat. $35^{\circ} 36' 30'' N.$; long. $124^{\circ} 45' 30'' W.$ Surface. 9.28 p. m. Surf. temp. 56° . 7 specimens.

Sur. 542. January 14, 1892. Lat. $35^{\circ} 31' N.$; long. $124^{\circ} 57' 30'' W.$ Surface. 7.19 p. m. Surf. temp. 56° . Many specimens.

Sur. 54. October 14, 1891. Lat. $35^{\circ} 03' 30'' N.$; long. $129^{\circ} 05' W.$ Surface. 3.33 p. m. Surf. temp. 65° . 1 specimen.

Sur. 74. October 16, 1891. Lat. $30^{\circ} 04' 30'' N.$; long. $133^{\circ} 56' 30'' W.$ 6.55 p. m. Surf. temp. 67° . 1 specimen.

Among the animals from the Hawaiian Islands recorded in 1905 by Ortmann as *E. bidentata* G. O. Sars, some specimens belong to *E. recurva*:

Sta. 3867. April 10, 1902. Pailolo Channel. Surf. temp. 75° . 1 specimen.

Sta. 3901. April 29, 1902. Pailolo Channel. Surface. 7.41 p. m. Surf. temp. 74° . 14 specimens.

Sta. 3926. May 10, 1902. Lat. $21^{\circ} 13' N.$; long. $158^{\circ} 43' W.$ Surface. 7.15 p. m. Surf. temp. 75° . 5 specimens.

Distribution.—A detailed account of the very wide distribution in the southern Atlantic, the Indian Ocean, Japan, and Lower California is found in my Harvard paper; two additional localities of the southern Atlantic have been noted in the Report on the Schizopoda from the Swedish Antarctic Expedition (1913).

¹ Trans. Linn. Soc. London, vol. 15, pt. 1, p. 130.

16. *EUPHAUSIA BREVIS* H. J. Hansen (1905).

1912. *Euphausia brevis* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 239, pl. 8, figs. 1a-1g.

Occurrence.—The unnamed material contained specimens from three places in the north Atlantic off the United States:

Sta. 2046. July 31, 1883. Lat. $40^{\circ} 02' 49''$ N.; long. $68^{\circ} 49'$ W. Surf. temp. 72° . 1 specimen.

Sta. 2569. August 31, 1885. Lat. $39^{\circ} 26'$ N.; long. $68^{\circ} 03' 30''$ W. Surf. temp. 75° . Many specimens. Surface. Many specimens.

Sta. 2585. September 19, 1885. Lat. $39^{\circ} 08' 30''$ N.; long. $72^{\circ} 17'$ W. Surf. temp. 73° . 1 specimen.

Furthermore the species has been gathered at a place in the south-east Pacific:

July 24, 25, 1888. Lat. 33° S.; long. $120^{\circ} 57'$ W. U. S. S. *Wachusett*. Dr. W. H. Jones, U. S. Navy. 10 specimens.

Among the specimens recorded by Ortmann in 1894 as *E. pellucida* Dana, the specimens from a single place belong to *E. brevis*:

Sur. 165. November 11, 1891. Lat. $30^{\circ} 23'$ N.; long. $140^{\circ} 36' 30''$ W. Surface. 6 p. m. Surf. temp. 69° . 4 specimens.

Among the animals from the Hawaiian Islands recorded in 1905 by Ortmann as *E. bidentata* G. O. Sars, a goodly number belong to *E. brevis*:

Sta. 3797. March 17, 1902. Lat. $31^{\circ} 55'$ N.; long. $136^{\circ} 00'$ W. Surface. 7.20 p. m. Surf. temp. 62° . 4 specimens. 25 feet below surface. 2 specimens.

Sta. 3867. April 10, 1902. Pailolo Channel. Surf. temp. 75° . 9 specimens.

Sta. 3901. April 29, 1902. Pailolo Channel. Surface. 7.41 p. m. Surf. temp. 74° . 2 specimens.

Distribution.—The extremely wide distribution of this small species has been recorded in my Harvard paper; a large number of localities in the tropical and temperate Atlantic, between lat. $37^{\circ} 58'$ N.; long. $16^{\circ} 21'$ W. and lat. $26^{\circ} 58'$ S.; long. $44^{\circ} 57'$ W., have been enumerated in my paper on the Schizopoda from the Swedish Antarctic Expedition (1913).

17. *EUPHAUSIA SUPERBA* Dana (1852).

1913. *Euphausia superba* H. J. HANSEN, Rep. Crust. Schizopoda coll. by the Swedish Antarctic Expedition, p. 27, pl. 4, figs. 2a-2g (with references to the papers of G. O. Sars and Tattersall).

Occurrence.—The collection contains a single specimen from the Antarctic Ocean presented by Prof. D'Arcy W. Thompson and determined as *E. murrayi* G. O. Sars, which is one of the synonyms of *E. superba*.

Distribution.—This species is antarctic and probably circumpolar. More detailed statements have been given or referred to in the paper quoted.

18. *EUPHAUSIA SIMILIS* G. O. Sars (1883).

1885. *Euphausia similis* G. O. Sars, *Challenger Rep.*, vol. 13, p. 79, pl. 13, figs. 1-6.

1911. *Euphausia similis* H. J. Hansen, *Bull. l'Inst. Océan. Monaco*, No. 210, p. 24 (with a text-figure).

1913. *Euphausia similis* H. J. Hansen, *Crust. Schiz. Swed. Antarctic Exp.*, p. 29, pl. 4, figs. 3a-3e.

Occurrence.—This species is at hand only from a couple of *Albatross* stations in the Pacific at Japan:

Sta. 3710. May 10, 1900. Entrance Port Heda, off Honshu Island, Japan. 800 fathoms. 1 specimen.

Sta. 4905. August 11, 1906. Lat. $31^{\circ} 39' N.$; long. $129^{\circ} 19' E.$; not far from Koshika Island, southern Japan. 369 fathoms. 1 specimen.

Remarks.—Both specimens are normal; that from Station 3710 is an adult male measuring 25.5 mm. in length.

Distribution.—This species is known from the South Atlantic, at lat. $37^{\circ} 17' S.$, and the adjacent parts of the subantarctic region (H. J. H., 1913¹), from the Indian Ocean (H. J. H., in 1910 and 1911, Tattersall, 1912), and from a place between New Zealand and Tasmania (H. J. H., 1911).

19. *EUPHAUSIA TENERA* H. J. Hansen (1905).

1885. *Euphausia gracilis* G. O. Sars, *Challenger Rep.*, vol. 13, p. 89, pl. 15, figs. 12-23 (not *E. gracilis* Dana).

1910. *Euphausia tenera* H. J. Hansen, *Siboga Exp.*, vol. 37, p. 95, pl. 14, figs. 3a-3e.

Occurrence.—Taken at five places in the Atlantic off the United States:

Sta. 2528. July 13, 1885. Lat. $41^{\circ} 47' N.$; long. $65^{\circ} 37' 30'' W.$ Surf. temp. 69° . 1 specimen.

Sta. 2091. September 21, 1883. Lat. $40^{\circ} 01' 50'' N.$; long. $70^{\circ} 50' W.$ Surf. temp. 69° . 2 specimens.

Sta. 2195. August 5, 1884. Lat. $39^{\circ} 44' N.$; long. $70^{\circ} 03' W.$ Surf. temp. 74° . 1 specimen.

Sta. 2569. August 31, 1885. Lat. $39^{\circ} 26' N.$; long. $68^{\circ} 03' 30'' W.$ Surf. temp. 75° . 6 specimens. Surface. Numerous specimens.

Grampus No. 5078. March 1, 1889. Lat. $25^{\circ} 34' 00'' N.$; long. $83^{\circ} 07' W.$ No. 5079. March 2, 1889. Lat. $25^{\circ} 34' 30'' N.$; long. $83^{\circ} 01' W.$ 3 specimens in all.

Besides, the species has been taken in the tropical East Pacific at a single station:

¹ In the enumeration of localities in my paper in question a misprint will be found. In the last line but one on p. 29 it should read, long. $36^{\circ} 21' W.$, instead of, long. $30^{\circ} 21' W.$

Sur. 26. April 3, 1888. Lat. $00^{\circ} 30' N.$; long. $88^{\circ} 37' 30'' W.$ Surface. 7.35 p. m. Surf. temp. 80° . Very large number of specimens.

Furthermore, Ortmann in 1894 has also recorded this species from three stations at the Galapagos: (He named the species *E. gracilis* Dana, but, as I pointed out in 1905, *E. gracilis* Dana is unrecognizable, and, besides, certainly not identical with *E. gracilis* G. O. Sars. I suppressed the name *gracilis*, naming the species described and figured by Sars, *E. tenera*.)

Sta. 3412. April 4, 1891. Lat. $1^{\circ} 23' N.$; long. $91^{\circ} 43' W.$ Surface. Surf. temp. 82° . 27 specimens.

Sta. 3419. April 3, 1891. Lat. $0^{\circ} 18' 40'' N.$; long. $90^{\circ} 34' W.$ Surface. Surf. temp. 82° . Numerous specimens.

Sta. 2628. March 26, 1891. Lat. $0^{\circ} 13' N.$; long. $84^{\circ} 52' W.$ 200–0 fathoms. 4 specimens.

Distribution.—The wide distribution of this fine and very slender species in the tropical Atlantic, the Indian Ocean, and some parts of the Pacific has been dealt with in the Harvard paper. Supplementary details on its distribution in the Indian Ocean and the Atlantic have been published, respectively, by Tattersall (1912) and myself (1913).

20. *EUPHAUSIA PACIFICA* H. J. Hansen (1911).

Plate 1, figs. 2a–2g.

1911. *Euphausia pacifica* H. J. HANSEN, Bull. l'Inst. Océan. Monaco, No. 210, p. 28, figs. 10, A and B.

1912. *Euphausia pacifica* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 241, pl. 7, figs. 5a–5b.

Occurrence.—This species is at hand from 24 localities (not including those of Ortmann for his *E. splendens* Dana—see below), all in the boreal or northern temperate Pacific; but as some of the localities are nearer to northeastern Asia, while the majority are found near America, from Alaska to near the southern end of California, I divide the localities into two groups, and as the line of separation between them the meridian of longitude $170^{\circ} W.$ is taken, because it runs through the middle of Bering Strait:

A. *American localities*.

Sta. 4753. October 1, 1905. Off Bushy Point, Alaska. Lat. $55^{\circ} 41' 30'' N.$; long. $131^{\circ} 46' 12'' W.$ 150–0 fathoms. 10 specimens.

Sta. 4760. May 21, 1906. Lat. $53^{\circ} 53' N.$; long. $144^{\circ} 53' W.$ 300–0 fathoms. 5 specimens.

Sta. 4759. May 20, 1906. Lat. $53^{\circ} 05' N.$; long. $138^{\circ} 31' W.$ 300–0 fathoms. 1 specimen.

Sta. 4758. May 19, 1906. Lat. $52^{\circ} 02' N.$; long. $132^{\circ} 53' W.$ 300–0 fathoms. 2 specimens.

Sta. 2861. May 31, 1888. Lat. $51^{\circ} 14' N.$; long. $129^{\circ} 50' W.$ 6 specimens.

Albatross, April 26, 1892. Off Vancouver Island. From floating kelp. 1 specimen.

Albatross, 1892. Off Cape Cook, Vancouver Island. 2 specimens.

Sta. 3449. August 28, 1891. Off Washington. Lat. $48^{\circ} 29' 40'' N.$; long. $124^{\circ} 40' 10'' W.$ 135-0 fathoms. 1 specimen.

Sta. 3444. August 27, 1891. Lat. $48^{\circ} 16' 30'' N.$; long. $123^{\circ} 49' 40'' W.$ 41-0 fathoms. Numerous specimens.

Sta. 4756. November 16, 1905. Lat. $47^{\circ} 37' 48'' N.$; long. $122^{\circ} 26' 20'' W.$ 75-0 fathoms. 2 specimens.

Sta. 4757. May 4, 1906. Lat. $39^{\circ} 18' N.$; long. $123^{\circ} 58' W.$ Enormous quantity of specimens.

Sta. 4468. May 13, 1904. Off Santa Cruz Lighthouse, Monterey Bay, Cal. (about lat. $36\frac{2}{3}^{\circ} N.$). Numerous specimens.

Sta. 4471. May 14, 1904. Off Point Pinos Lighthouse, Monterey Bay, Cal. 3 specimens.

Sta. 4515. May 23, 1904. Off Point Pinos Lighthouse, Monterey Bay, Cal. 5 specimens.

Sta. 4528. May 27, 1904. Off Point Pinos Lighthouse, Monterey Bay, Cal. 2 specimens.

Sta. 4529. May 27, 1904. Off Point Pinos Lighthouse, Monterey Bay, Cal. 2 specimens.

Sta. 4533. May 28, 1904. Off Point Pinos Lighthouse, Monterey Bay, Cal. 1 specimen.

Sta. 4536. May 31, 1904. Off Point Pinos Lighthouse, Monterey Bay, Cal. 2 specimens.

Sta. 4537. May 31, 1904. Off Point Pinos Lighthouse, Monterey Bay, Cal. 2 specimens.

Sta. 4382. March 18, 1904. Off south point North Coronado Island, vicinity of San Diego, Cal. (about lat. $32\frac{2}{3}^{\circ} N.$). Surface. 1 immature specimen.

B. Localities off Asia.

Sta. 4793. June 16, 1906. Lat. $54^{\circ} 48' N.$; long. $165^{\circ} 54' E.$ Near Bering Island. 300-0 fathoms. 3 specimens.

Sta. 4785. June 12, 1906. Lat. $53^{\circ} 20' N.$; long. $170^{\circ} 33' E.$ 300-0 fathoms. 1 specimen.

Sta. 5030. Sept. 29, 1906. Lat. $46^{\circ} 29' 30'' N.$; long. $145^{\circ} 46' E.$ 300-0 fathoms. 15 specimens.

Sta. 4806. June 26, 1906. Lat. $42^{\circ} 13' N.$; long. $144^{\circ} 21' E.$ Near northern Japan. 200-0 fathoms. 18 specimens.

Furthermore, all specimens recorded by Ortmann in 1894 as *E. splendens* Dana belong to *E. pacifica*. The localities are situated between San Francisco and the Hawaiian Islands:

Sur. 543. January 14, 1892. Lat. $35^{\circ} 36' 30''$ N.; long. $124^{\circ} 45' 30''$ W. Surface. 9.28 p. m. Surf. temp. 56° . 9 specimens.

Sur. 542. January 14, 1892. Lat. $35^{\circ} 31' 30''$ N.; long. $124^{\circ} 57' 30''$ W. Surface. 7.19 p. m. Surf. temp. 56° . Many specimens.

Sur. 541. January 14, 1892. Lat. $35^{\circ} 25' 30''$ N.; long. $125^{\circ} 09' 30''$ W. 5.17 p. m. 300–0 fathoms. 4 specimens.

Sur. 540. January 14, 1892. Lat. $35^{\circ} 19' 30''$ N.; long. $125^{\circ} 21' 30''$ W. 1.58 p. m. 300–0 fathoms. 5 specimens.

Description.—The front margin of the carapace, seen from above (fig. 2a), in the main is transverse, yet having each half of the margin distinctly concave, as the median half is produced a little forward, forming a very short frontal plate, with the end rounded or angular, but without any rostral process. The gastric area without median keel; the lateral margin of the carapace with a well-developed denticle a little before the middle. The eyes very large.

Antennulæ (figs. 2a–2d), with the first joint at the upper, inner distal angle a little protruding and produced into a very small acute triangle (fig. 2b), longer than broad, and directed forward somewhat or slightly outward and much upward (figs. 2c–2d). Second and third joints distinctly more slender than in *E. lucens*; second joint above at the inner angle distally produced in a small or very small spine; second joint longer than the third, which is thicker in the male (fig. 2c) than in the female (fig. 2d). The dorsal carina, on third joint, is moderately developed, with its front margin very oblique and frequently a little concave beyond the upper angle.

The copulatory organs (figs. 2e–2g) afford excellent characters. The terminal process (p^2) is moderately short and somewhat thick, a little thicker than in *E. lucens* and *E. frigida*; the foot (f) is rather long and the heel (h) somewhat short, with the end angular; seen from behind (fig. 2f) the process has its most distal part a little broader than beyond the middle, with the end seemingly flatly rounded, but seen from the inner side (fig. 2g) the distal part of the process shows itself to be much larger, but bent nearly angularly forward, as a very oblong, distally obtuse, irregularly shaped plate. The proximal process (p^3) is somewhat longer than the terminal (fig. 2f), but far from reaching its end. It has no secondary branch on the outer side; its distal part is, seen from behind (fig. 2f), gradually much compressed; seen from the inner side (fig. 2g) this part shows itself to be a large, very oblong, distally rounded plate bent very strongly backward, thus forming a nearly right angle with the remainder of the process. On the distal margin of this plate, near its base, an incision is seen, and a comparison with the structure in *E. frigida* and *E. lucens* shows that the plate is the extremely elongate posterior (or right) wing of the terminal expansion found in these two species. The lateral process (p^4) is long, distally much

curved, without secondary tooth. The setiferous lobe (fig. 2e, *ls*) has, besides the six distal, strong and long setæ, three thinner setæ on the distal part of the inner margin and five fine setæ distributed along nearly the whole outer margin; the oblique triangular lobe constituting a kind of pouch is very large.

Length.—One of the largest females (from lat. $39^{\circ} 18' N.$) is 22 mm. long and a large male (from off Vancouver Island) is 21.5 mm. long.

Remarks.—This species is distinguished from *E. lucens* H. J. Hansen and *E. frigida* H. J. Hansen, especially by the shape of the processes of the copulatory organs; furthermore, by the very short frontal plate, the shape of the lobe of the first antennular joint, and other minor points in the antennulæ.

Distribution.—To the interesting distribution shown by the lists above it must be added that the Copenhagen Museum possesses specimens from seven localities situated at Formosa, and especially near Japan and Korea northward to lat. $39^{\circ} N.$; finally, that a number of immature specimens were taken between San Francisco and the Hawaiian Islands in lat. $33^{\circ} 40' N.$ (Harvard paper).

21. *EUPHAUSIA LUCENS* H. J. Hansen (1905).

1885. *Euphausia splendens* G. O. Sars, *Challenger Rep.*, vol. 13, p. 80, pl. 13, figs. 7-17.

1911. *Euphausia lucens* H. J. Hansen, *Bull. l'Inst. Océan. Monaco*, No. 210, p. 26, fig. 8, A and B.

Occurrence.—Taken only at a single place in the South Atlantic:

Sur. 12. January 15, 1888. Lat. $45^{\circ} 22' S.$; long. $64^{\circ} 20' W.$ Surface. 12.10 p. m. Surf. temp. 58° . 2 specimens.

Distribution.—According to my paper quoted this species has been taken four times in the southeast Atlantic and at a place between New Zealand and Tasmania, while three of the places given by Sars remain doubtful. In 1913 Tattersall¹ enumerated three additional localities in the southeast Atlantic nearly west of the Cape of Good Hope.

22. *EUPHAUSIA HEMIGIBBA* H. J. Hansen (1910).

1910. *Euphausia hemigibba* H. J. Hansen, *Siboga-Exp.*, vol. 37, p. 100, pl. 14, figs. 5a-5f.

Occurrence.—Taken by the *Albatross* at three stations in the north-west Atlantic:

Sta. 2190. August 4, 1884. Lat. $39^{\circ} 40' N.$; long. $70^{\circ} 20' 15'' W.$ Surf. temp. 73° . 3 specimens.

Sta. 2683. July 17, 1886. Lat. $39^{\circ} 33' N.$; long. $70^{\circ} 50' W.$ 1 specimen.

Sta. 2569. August 31, 1885. Lat. $39^{\circ} 26' N.$; long. $68^{\circ} 03' 30'' W.$ Surface. Surf. temp. 75° . 3 specimens.

¹Trans. Royal Soc. Edinburgh, vol. 49, pt. 4.

Furthermore, the specimens from the Hawaiian Islands referred by Ortmann in 1905 to *E. pseudogibba* Ortmann belong to *E. hemigibba* (compare my statements on the interpretation of the species in the above-quoted paper, p. 99):

Sta. 3799. March 18, 1902. Lat. $29^{\circ} 22' N.$; long. $139^{\circ} 31' W.$ 100–0 fathoms. 1 specimen.

Sta. 3867. April 10, 1902. Pailolo Channel. Surf. temp. 75° . 1 specimen.

Distribution.—*E. hemigibba* is very common in the Atlantic from lat. $42^{\circ} N.$ to southwest of the Cape of Good Hope, and in the Indian Ocean from Port Elizabeth to long. $129^{\circ} E.$

23. EUPHAUSIA GIBBA G. O. Sars (1883).

1885. *Euphausia gibba* G. O. Sars, *Challenger Rep.*, vol. 13, p. 91, pl. 16, figs. 1–8.

1912. *Euphausia gibba* H. J. Hansen, *Mem. Mus. Comp. Zool.*, vol. 35, No. 4, p. 244, pl. 8, figs. 2a–2b.

Occurrence.—Only a single specimen, from the southeast Pacific, is at hand:

August 10, 1884. Lat. $29^{\circ} 33' S.$; long. $87^{\circ} 34' W.$ U. S. S. *Wachusett*, Dr. W. H. Jones, U. S. Navy. 1 specimen (male).

Distribution.—It is known only from the Pacific south of the line, going northward at least to lat. $16^{\circ} 32' S.$

24. EUPHAUSIA DISTINGUENDA H. J. Hansen (1911).

1912. *Euphausia distinguenda* H. J. Hansen, *Mem. Mus. Comp. Zool.*, vol. 35, No. 4, p. 248, pl. 8, figs. 3a–3f.

Occurrence.—Among the material received without determinations no specimen was found, but the majority of the specimens referred by Ortmann in 1894 to *E. mucronata* G. O. Sars belong to *E. distinguenda*:

Off Guaymas, Gulf of California (about lat. $28^{\circ} N.$). 500–0 fathoms. 1 specimen.

120 miles northwest of Acapulco (about lat. $17\frac{1}{2}^{\circ} N.$). 175–0 fathoms. 5 specimens.

Sta. 3416. April 11, 1891. Lat. $16^{\circ} 32' 30'' N.$; long. $99^{\circ} 42' 40'' W.$ 300–0 fathoms. 1 specimen.

Lat. $13^{\circ} 33' 30'' N.$; long. $97^{\circ} 57' 30'' W.$ Surface. 8 p. m. 12 specimens.

Sta. 3414. April 8, 1891. Lat. $10^{\circ} 14' N.$; long. $96^{\circ} 28' W.$ 200–0 fathoms. 2 specimens. 300–0 fathoms. 2 specimens.

Hyd. 2619. March 11, 1891. Lat. $7^{\circ} 31' N.$; long. $78^{\circ} 42' 35'' W.$ 300–0 fathoms. 6 specimens. 1,000–0 fathoms. 2 specimens.

Sta. 3382. March 7, 1891. Lat. $6^{\circ} 21' N.$; long. $80^{\circ} 11' W.$ 200 fathoms. Closed part of Tanner net. 7 specimens.

Sta. 3412. April 4, 1891. Galapagos. Lat. $1^{\circ} 23' N.$; long. $91^{\circ} 43' W.$ Surface. Surf. temp. 82° . Many specimens.

Distribution.—In the Harvard paper a long list of localities situated in the east Pacific between lat. $22\frac{3}{4}^{\circ}$ N. and lat. $12\frac{1}{2}^{\circ}$ S. has been published.

25. *EUPHAUSIA LAMELLIGERA* H. J. Hansen (1911).

1912. *Euphausia lamelligera* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 250, pl. 8, figs. 4a-4e; pl. 9, fig. 1a.

Occurrence.—Among the unnamed material specimens are at hand from only a single station in the tropical east Pacific:

Sur. 16. March 1, 1888. Lat. $4^{\circ} 21'$ S.; long. $81^{\circ} 50'$ W. Surface. 4.31 a. m. Moonlight. Surf. temp. 74° . 4 specimens.

Besides, some of the specimens referred by Ortmann in 1894 to *E. mucronata* G. O. Sars belong to *E. lamelligera*:

Hyd. 2619. March 11, 1891. Lat. $7^{\circ} 31'$ N.; long. $78^{\circ} 42' 30''$ W. 300-0 fathoms. 6 specimens. 1,000-0 fathoms. 12 specimens.

Sta. 3388. March 9, 1891. Lat. $7^{\circ} 06'$ N.; long. $79^{\circ} 48'$ W. 400-0 fathoms. 19 specimens.

March 7, 1891, thus near lat. $6^{\circ} 21'$ N.; long. $80^{\circ} 41'$ W. Surface. 1 specimen.

Distribution.—This species is, as shown in the paper quoted, rather common in the tropical east Pacific between lat. $19^{\circ} 52'$ N. and lat. $10^{\circ} 17'$ S.

26. *EUPHAUSIA GIBBOIDES* Ortmann (1893).

1912. *Euphausia gibboides* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 252, pl. 9, figs. 2a-2b.

Occurrence.—The unnamed material contains specimens from a station in the northwest Atlantic and from a place in the tropical east Pacific off Chile:

Sta. 2098. October 1, 1883. Northwest Atlantic. Lat. $37^{\circ} 40' 30''$ N.; long. $70^{\circ} 37' 30''$ W. 1 specimen.

Sta. 2808. April 4, 1888. East Pacific. Lat. $0^{\circ} 36' 30''$ N.; long. $89^{\circ} 19'$ W. 1 specimen (male).

Furthermore, Ortmann in 1894 correctly referred specimens from three stations in the Pacific to this species:

Sur. 540. January 14, 1891. Lat. $35^{\circ} 19' 30''$ N.; long. $125^{\circ} 21' 30''$ W. 300-0 fathoms. 3 specimens.

Hyd. 2627. March 25, 1891. Lat. $0^{\circ} 36'$ N.; long. $82^{\circ} 45'$ W. 1,832-0 fathoms. 1 specimen (male).

Hyd. 2628. March 26, 1891. Lat. $0^{\circ} 13'$ S.; long. $84^{\circ} 52'$ W. 200-0 fathoms. 1 specimen.

Finally I found a somewhat young specimen of this species among the specimens referred by Ortmann to *E. mucronata* G. O. Sars from the following locality:

Sta. 3414. April 8, 1891. Lat. $10^{\circ} 14'$ N.; long. $96^{\circ} 28'$ W. 300-0 fathoms. 1 specimen.

Distribution.—The distribution in the Atlantic and in parts of the Pacific has been dealt with in the Harvard paper quoted. In 1913 Tattersall added a locality in the southeast Atlantic, west of the Cape of Good Hope.

Genus THYSANOESSA Brandt.

This difficult genus comprises nine species and has been dealt with to some extent in my preliminary account of the order (1911). The American collection comprises seven species, thus all forms excepting two exclusively Antarctic species.

27. THYSANOESSA LONGIPES Brandt.

Plate 1, figs. 3a-3d; plate 2, figs. 1a-1e.

1851. *Thysanoessa longipes* BRANDT, KREBSE, in MIDDENDORFF'S SIBIRISCHE REISE, vol. 2, pt. 1, p. 128, pl. 6, figs. 1-14.

1911. *Thysanoëssa longipes* H. J. HANSEN, Bull. l'Inst. Océan. Monaco, No. 210, pp. 38 and 40.

Occurrence.—Taken at no less than 14 places in the colder temperate north Pacific and Bering Sea:

A. Localities mainly American.

April 18, 1892. Off Cape St. Elias. About lat. 60° N.; long. 144° W. 1 specimen.

Sta. 4753. October 1, 1905. Lat. 55° 41' 30'' N.; long. 131° 46' 12'' W. 150-0 fathoms. 4 specimens.

Sta. 4763. May 28, 1906. Lat. 53° 57' N.; long. 168° 06' W. 300-0 fathoms. 1 specimen.

Sta. 3329. August 21, 1890. Lat. 53° 56' 50'' N.; long. 167° 08' 15'' W. 1 specimen.

Sta. 3307. August 3, 1890. Lat. 53° 55' N.; long. 170° 50' W. 5 specimens.

Sta. 4765. May 29, 1906. Lat. 53° 12' N.; long. 171° 37' W. 300-0 fathoms. 2 specimens.

Sta. 4766. May 31, 1906. Lat. 52° 38' N.; long. 174° 49' W. 300-0 fathoms. 17 specimens.

April 5, 1913. From stomach of salmon caught between Tacoma and Seattle, Washington. C. H. Gilbert. ½ specimen.

B. Localities mainly Asiatic.

Sta. 4793. June 16, 1906. Near Bering Island. Lat. 54° 48' N.; long. 164° 54' E. 300-0 fathoms. 1 specimen.

Sta. 4767. June 3, 1906. Lat. 54° 12' N.; long. 179° 07' 30'' E. 300-0 fathoms. 3 specimens.

Sta. 4785. June 12, 1906. Lat. 53° 20' N.; long. 170° 33' E. 300-0 fathoms. 2 specimens.

Sta. 4800. June 22, 1906. Lat. 49° 06' N.; long. 153° 06' E. 300-0 fathoms. 4 specimens.

Sta. 4802. June 24, 1906. Lat. $46^{\circ} 44' N.$; long. $151^{\circ} 44' E.$ 1 specimen.

Sta. 5030. September 29, 1906. Lat. $46^{\circ} 29' 40'' N.$; long. $145^{\circ} 46' E.$ 300-0 fathoms. Large number of specimens.

Description.—Rostrum long, rather narrow, distally acuminate (fig. 1*b*), slightly more slender in the male than in the female. The most anterior part of the carapace both above and on each side conspicuously protruding and curved somewhat outward as a kind of collar, most protruding at the limit between the side and the upper surface, and its margin at that limit forming a rounded or subacute angle. The major anterior part of the gastric area (fig. 1*b*) has a well-developed median keel which also runs along the rostrum to near the apex; between this keel and each lateral margin the rostrum is hollowed longitudinally, and this excavation is continued backwards and outwards as a deep, straight impression, the anterior part of which constitutes the limit between the gastric area and the collar-like produced anterolateral portion of the carapace. The lateral margin of the carapace has a distinct denticle somewhat behind the middle.

Eyes large (figs. 1*a*–1*b*), with a conspicuous transverse constriction considerably above the middle, and the upper section is much narrower and lower than the inferior section. Antennulæ in the female (pl. 2, fig. 1*a*; pl. 1, fig. 3*a*) with the two distal peduncular joints long and slender, the third joint conspicuously more slender and a little longer than the second; in the male (pl. 1, fig. 3*b*) both joints are conspicuously shorter and thicker, the third joint scarcely or slightly longer and a little thinner than the second. Antennular flagella (fig. 1*a*) in both sexes thin with many joints and the upper flagellum slightly shorter than the lower; in the female the flagella are somewhat longer than the sum of the two distal peduncular joints; in the male they are proportionately a little longer than in the female. Antennal squama (pl. 2, fig. 1*b*) somewhat narrow, with a tooth on the outer distal angle; the squama reaches in the female to the middle, in the male beyond the middle, of the third antennular joint.

Maxillulæ nearly as in *T. gregaria* (compare Sars, 1885); maxillæ a little longer in proportion to breadth than in *T. gregaria*. Maxillipeds normal, in the main as in *T. gregaria*; the distal part with its setæ is shown in plate 1, fig. 3*c*.

First pair of thoracic legs (pl. 2, fig. 1*a*) very elongate, with the fourth joint reaching beyond the end of the antennular peduncles. These legs are strong, and especially the third joint and the proximal half of the fourth joint are very robust, much thickened; fifth joint somewhat arcuate with some few setæ along the distal part of both margins; sixth joint somewhat long, about two-fifths as long as the

fifth, with about nine somewhat spiniform setæ along its prehensile margin; seventh joint considerably deeper than long, with four spiniform setæ. The following pairs of legs with their setæ fine and the majority of them very finely plumose. Endopod of sixth pair in the female (pl. 1, fig. 3*d*) one-jointed, very small, much less than half as long as the exopod.

First to fifth abdominal segments (pl. 2, fig. 1*c*) each with the posterolateral angle of the side plates produced into an acute tooth. Third, fourth, and fifth segment each with a considerably raised, sharp median keel, which on the third segment is very high and posteriorly produced into a long, compressed, horizontal process; in the fourth and fifth segments the process is small, acute; the sixth segment has no real dorsal keel, but terminates above in a similar small spiniform process. Posterior margin of fourth and fifth segments armed above with a small, sharp tooth at some distance from the median process. First and second segments dorsally somewhat raised toward the hind margin, and second segment frequently with a more or less distinct, short and low keel. Sixth segment rather long, a little shorter than the sum of the two preceding segments; its lower distal spine is well developed but simple in both sexes. Telson with two pairs of small dorsal spines; it is about as long as the endopod of the uropods which is slightly longer than the exopod.

The copulatory organs of first pair of pleopods (pl. 2, figs. 1*d* and 1*e*) with most parts somewhat elongated. The spine-shaped process (p^1) somewhat long and much curved. The terminal process (p^2) somewhat slender and a little before the middle much curved, tapering at most slightly from the curvature to near the obtuse end. The proximal process (p^3), which is somewhat less curved and toward the base a little less thick than the terminal process, is a little longer than the latter, but does not fully reach its distal end; in other respects the shape is rather similar. The median lobe (lm) is long and rather narrow, with the end comparatively broad and obliquely emarginate; the lateral process (p^4), which originates somewhat before the middle of the lobe and considerably beyond the insertion of the proximal process, reaches to near the end of the lobe and is very long, feebly curved and regularly tapering to its acute end. The auxiliary lobe (lu) is well developed. The setiferous lobe (ls) is rather narrow, with plumose setæ along both margins to a short distance from their base.

Length.—The largest female (from Station 5030) is 30 mm., an adult male 24 mm. long.

Remarks.—As Prof. Brandt had but poor material of this large and fine species at his disposal, his description and representation are imperfect. But when some later zoologists referred *T. longipes* as a synonym to *T. inermis* Krøyer (*T. neglecta* Krøyer, *T. borealis*

G. O. Sars) they ought to have taken Brandt's description of the dorsal armature into consideration. The species is easily separated from all other forms of the genus excepting *T. spinifera* Holmes by having some abdominal segments dorsally carinate and armed with spiniform processes; from *T. spinifera* it is separated by several excellent differences (eyes, antennulæ in the males, prehensile legs, abdominal armature, etc.).

Distribution.—Brandt's specimens were from the Sea of Okhotsk. With this exception the list above comprises our total knowledge of the distribution of *T. longipes*.

28. *THYSANOESSA SPINIFERA* Holmes (1900).

Plate 3, figs. 1a-1k.

1900. *Thysanoessa spinifera* HOLMES, Occ. Papers Cal. Acad. Sciences, vol. 7, p. 229, pl. 4, fig. 81.

1911. *Thysanoëssa spinifera* H. J. HANSEN, Bull. l'Inst. Océan. Monaco, No. 210, pp. 38 and 41.

Occurrence.—Taken at places in Bering Sea and the North Pacific along America from Alaska to near the southern end of California.

Hyd. 3242. June 5, 1893. Lat. $57^{\circ} 40' N.$; long. $143^{\circ} 18' W.$ Off Alaska. 1 specimen.

Sta. 4753. October 1, 1905. Lat. $55^{\circ} 41' 30'' N.$; long. $131^{\circ} 46' 12'' W.$ 150-0 fathoms. 3 specimens.

Sta. 3263. June 24, 1893. Bering Sea. Lat. $55^{\circ} 04' N.$; long. $165^{\circ} 04' W.$ 1 specimen.

Sta. 4767. June 3, 1906. Lat. $54^{\circ} 12' N.$; long. $179^{\circ} 07' 30'' E.$ 300-0 fathoms. 1 specimen.

Sta. 4758. May 19, 1906. Lat. $52^{\circ} 02' N.$; long. $132^{\circ} 53' W.$ 300-0 fathoms. 1 specimen (male).

Albatross, 1888. Barclay Sound, Vancouver Island. (About lat. $49^{\circ} N.$; long. $125^{\circ} W.$) Electric light. 4 specimens (male, female). Surface. 1 specimen.

Sta. 3444. August 27, 1891. Lat. $48^{\circ} 16' 30'' N.$; long. $123^{\circ} 29' 40'' W.$ About 15 specimens.

April 5, 1913. From stomach of salmon caught between Tacoma and Seattle, Washington. C. H. Gilbert. 2 specimens.

Sta. 4757. May 4, 1906. Lat. $39^{\circ} 18' N.$; long. $123^{\circ} 58' W.$ 2 young specimens.

Sta. 4426. April 14, 1904. Off Point San Pedro, Santa Cruz Island, California. (About $34^{\circ} N.$) 1 specimen.

Sta. 4367. March 16, 1904. Point Loma L. H., vicinity of San Diego, California. (About lat. $32\frac{2}{3}^{\circ} N.$) 1 specimen.

Description.—Rostrum (fig. 1b) very long, somewhat tapering, acuminate and very acute, equal in both sexes or in the male slightly narrower than in the female. The most anterior part of the carapace

somewhat outstanding, collarlike, and at the limit between the side and the upper surface produced as a triangular, flat, very acute process directed forward and outward. The gastric area with a conspicuous median keel to near its hind margin; this keel continues forward along the rostrum to considerably beyond its middle, while between this keel and the lateral margin the rostrum is hollowed longitudinally, and this canaliculation is continued backward and outward as a somewhat curved, deeply impressed line limiting the gastric area at the side. The lateral margin of the carapace has no denticle.

Eyes large, seen from the side (fig. 1a) subcircular, being slightly higher than broad, feebly narrowing upward, but without any transverse constriction. Antennulæ in the female (fig. 1c) with the two distal peduncular joints differing from those in *T. longipes*, being distinctly less slender than in that species, and the second joint is a little longer and distinctly thicker than the third. In the male (figs. 1a and 1d) the second joint is still longer in proportion to the third than in the female, both second and third joints are conspicuously thicker and the third somewhat thickened toward the end, while the second has the inner half of its distal upper end produced upward and forward as a broadly rounded lobe, which along its free terminal and upper margin is adorned with setæ closely arranged in longitudinal rows; these setæ constitute a compressed brush, and their ends are curved in a peculiar way; seen from the side the third joint seems to be inserted on the outer side of the second. The antennular flagella are well preserved in an adult male (fig. 1a); the lower flagellum is about as long as the peduncle and much longer than the upper flagellum, which is somewhat longer than the sum of the two distal peduncular joints. The antennal squama reaches in the female a little beyond, in the male scarcely to, the end of the second joint of the antennulæ; the denticle at the end of the outer margin is well developed. The squama is distally broader than in *T. longipes*, with the end cut more transversely.

Maxillulæ and maxillæ nearly as in the preceding species. Maxillipeds normal; fig. 1e exhibits the distal part with its setæ.

First pair of thoracic legs (figs. 1a and 1f) comparatively feebly elongate, being from a little to considerably longer but conspicuously thicker than the second pair; the fourth joint reaches to or at most a little beyond the end of the first antennular joint. Fifth joint with naked setæ along the major part of both margins; sixth joint not much shorter than the fifth, with 7 glabrous setæ along the prehensile margin, and these setæ are moderately strong and most of them very long; seventh joint longer than deep, with 5 stiff setæ and 3 among them nearly spiniform. Second pair of legs (fig. 1f) normal; the setæ along the lower (posterior) margin very long and distinctly plumose; seventh joint at least twice as long as that of the first pair.

Endopod of sixth pair in the female one-jointed, not half as long as the exopod.

The abdominal segments (fig. 1g) dorsally carinate, but the keel is feebly developed on the sixth segment and wanting on about the anterior half of the first segment and on a smaller anterior part of the second and third segments, while in the fourth and fifth segments the keel is high and besides on each produced in a good-sized, compressed, horizontal process, which generally is a little longer on the fourth than on the fifth segment; the sixth segment terminates above in a process about as large as that of the fifth segment; the lower distal spine on the sixth segment is simple in both sexes. Fourth and fifth segments with the upper sublateral teeth rudimentary (they are well developed in *T. longipes*), while the lateral plates of the segments are nearly as in the preceding species. Sixth segment much shorter than in *T. longipes* and only a little longer than the fifth. Telson as in *T. longipes*; uropods about as long as or a little shorter than the telson.

(In one immature specimen measuring 16.2 mm. in length the otherwise very acute angle at the outer end of the front upper margin of the carapace is rounded; the abdomen has no keel on the first and second segments, while the keel is very feeble on the third and sixth segments; furthermore the fourth segment has no posterior dorsal spine, while the spines on the fifth and sixth segments are well developed. Some of these reductions may be due to the young age of the specimen, others to variation.)

Male copulatory organs of first pleopods (figs. 1h-1k) differ from those in *T. longipes* in having the three large processes conspicuously shorter and thicker and the setiferous lobe a little broader. The spine-shaped process (p^1) is long and much curved. The terminal process (p^2) has a little less than the proximal half rather thick and then it is suddenly somewhat (fig. 1i) or considerably (fig. 1k) curved, with the distal half much narrower than the proximal part and the end acute and turned outward. The proximal process (p^3) has the proximal part considerably less thickened than in the terminal process; it is straight (fig. 1i) or a little curved just before the middle (fig. 1k) and its end shaped about as that of the terminal process. The median lobe (lm) not differing essentially from that in *T. longipes*, but its lateral process (p^4) is inserted nearer the base and slightly or scarcely beyond the base of the proximal process; the process, which is far from reaching the end of the lobe, is somewhat curved (fig. 1i) or straight (fig. 1k) with the end acute or subacute. Figs. 1h and 1i represent the organ of a male which perhaps is not quite adult, as the inner and the median lobes with their processes are uncommonly short in proportion to the setiferous lobe, the processes simple, solid at their acute ends and the auxiliary lobe

conspicuously more than two-thirds as long as the median lobe. Fig. 1*k* represents the process-bearing lobes of the left organ of a large male, and in this organ the inner and the median lobes and their large processes are somewhat longer in proportion to the setiferous lobe than in the organ shown in fig. 1*h*, in reality showing the same length in proportion to the setiferous lobe as in *T. longipes* (pl. 2, fig. 1*d*); furthermore, the two largest processes of this organ look as if their terminal part is hollowed on the outer side, and the end of all three large processes is less produced and more convex on the inner side; finally, the auxiliary lobe is slightly more than half as long as the median lobe.

Length.—The largest female (from station 4426) is 26 mm.; the largest male (from station 3444) is 25.5 mm. long.

Remarks.—This specimen was established by Holmes on a single specimen, and his description, together with a figure, is good. *T. spinifera* is easily distinguished from *T. longipes* by many characters, among which may be mentioned: The absence of a tooth on the lateral margin of the carapace; the subcircular, not constricted eyes; the third joint of the antennular peduncle shorter than the second; the protruding setiferous lobe at the end of the second antennular joint in the male; no dorsal spine on the third abdominal segment; and the spines on the following segments larger than in *T. longipes*.

Distribution.—The type was caught near Fort Bragg, California, near lat. $39\frac{1}{2}^{\circ}$ N. The remarks on occurrence and the list of localities comprise our total knowledge of the distribution of *T. spinifera*.

29. THYSANOESSA INERMIS Krøyer (?1846).

Plate 2, figs. 2*a*–2*d*.

1882. *Euphausia inermis* G. O. Sars, Forh. Vid. Selsk. Christiania for 1882, No. 18, p. 51, pl. 1, fig. 15.

1882. *Thysanoëssa borealis* G. O. Sars, Forh. Vid. Selsk. Christiania for 1882, No. 18, p. 52, pl. 1, figs. 16–18.

1911. *Thysanoëssa inermis* H. J. Hansen, Bull. l'Inst. Océan. Monaco, No. 210, pp. 8–13 and p. 38.

Occurrence.—As discussed in the last-named paper, *Rhoda* (*Boreophausia*) *inermis* Krøyer and *Thysanoëssa neglecta* Krøyer (*T. borealis* G. O. Sars) are varieties of the same species; they are frequently clearly distinguished from each other by the structure of the first pair of thoracic legs, but sometimes transitions between both forms are found. Frequently all animals captured at a locality belong to the same form or variety, but sometimes both have been taken in the same haul. In the following list of the localities in the Atlantic a word on this topic is added at most stations. The specimens from the Pacific are mentioned separately.

October 12, 13, 17, 1879. Eastport (about lat. $44^{\circ} 54' N.$). Surface. R. Rathbun. 5 specimens. (Var. *T. neglecta*.)

Sta. 2513. July 11, 1885. Lat. $43^{\circ} 34' N.$; long. $63^{\circ} 56' 30'' W.$ Off Nova Scotia. 1 specimen. (Var. *T. neglecta.*)

Grampus No. 240. May 24, 1893. Lat. $42^{\circ} 48' N.$; long. $65^{\circ} 40' W.$ 2 specimens. (Var. *Rhoda.*)

Sta. 191. August 31, 1878. About lat. $42^{\circ} 33\frac{1}{2}' N.$; long. $69^{\circ} 58' W.$ 1 specimen. (Var. *Rhoda.*)

Sta. 139. July 29, 1878. Off Thatchers Island, thus about lat. $42\frac{1}{2}^{\circ} N.$; long. $70\frac{1}{2}^{\circ} W.$ 1 young specimen. (Var. *T. neglecta.*)

Sta. 1080. August 2, 1881. Off Cape Cod (about lat. $42\frac{1}{3}^{\circ} N.$). 8 specimens. (Var. *T. neglecta.*)

Sta. 1081. August 2, 1881. Off Cape Cod. 8 specimens. (Var. *Rhoda.*)

Sta. 1083. August 2, 1881. Off Cape Cod. 12 specimens. (Both forms).

Sta. 1087. August 3, 1881. Off Cape Cod. 2 specimens. (Var. *T. neglecta.*)

Sta. 1089. August 3, 1881. Off Cape Cod. 8 specimens. (Both forms.)

Sta. 1090. August 3, 1881. Off Cape Cod. 7 specimens. (Var. *Rhoda.*)

Woods Hole region, about lat. $41^{\circ} 32' N.$ Large number of specimens of both forms taken on several occasions.

Vineyard Sound. V. N. Edwards. 2 specimens, adult male. (Var. *Rhoda.*) January 12, 14, 1880. Surface. 1 half-grown specimen.

Sta. 917. July 16, 1881. Lat. $40^{\circ} 22' N.$; long. $70^{\circ} 42' W.$ Stomach of *Phycis tenuis*. Large number of immature specimens.

Grampus No. 82. April 27, 1894. Lat. $38^{\circ} 42' N.$; long. $74^{\circ} 02' W.$ Tow-net. 1 specimen. (Var. *Rhoda.*)

Grampus No. 34. April 23, 1894. Lat. $38^{\circ} 15' N.$; long. $74^{\circ} 18' W.$ Tow-net. Numerous specimens. (Var. *Rhoda.*)

From Bering Sea and the adjacent area of the North Pacific this species is at hand from eight localities. All specimens seem to be forma *Rhoda*, but their number is somewhat small (excepting from Iliuliuk) and many among them are rather poorly preserved:

July 5, 1890. St. Paul Island (about lat. $57\frac{1}{2}^{\circ} N.$; long. $170^{\circ} W.$). W. Palmer. 1 specimen.

Sta. 2847. July 31, 1888. Lat. $55^{\circ} 01' N.$; long. $160^{\circ} 12' E.$ 1 specimen.

Sta. 4793. June 14, 1906. Lat. $54^{\circ} 36' 15'' N.$; long. $166^{\circ} 58' 15'' E.$ Near Bering Island. 300-0 fathoms. 2 specimens.

Sta. 3310. August 15, 1890. Lat. $53^{\circ} 56' 51'' N.$; long. $166^{\circ} 28' 53'' W.$ $2\frac{1}{2}$ specimens.

Iliuliuk, Unalaska. About lat. $53^{\circ} 53' N.$; long. $166^{\circ} 32' W.$ W. H. Dall. Half pint of specimens.

Sta. 4762. May 24, 1906. Lat. $53^{\circ} 46' N.$; long. $164^{\circ} 29' W.$ 2 specimens.

Sta. 5030. September 29, 1906. Lat. $46^{\circ} 39' 30'' N.$; long $145^{\circ} 46' E.$ 300–0 fathoms. 15 specimens.

Sur. 32. Locality unknown. 3 specimens.

Remarks.—The dorsal spiniform process on the sixth abdominal segment is always well developed. In the majority of the specimens from the Pacific the fifth abdominal segment has also a dorsal spine which sometimes is proportionately long, sometimes rather short, sometimes nearly or completely rudimentary, and in rare cases wanting. In specimens from the Atlantic the fifth segment has generally no dorsal spine, but among the specimens caught at station 1081, off Cape Cod, this segment has in one specimen a very conspicuous, somewhat long, and strong spine, while in a second specimen the spine is rudimentary.

Of the very remarkable variation of this species a detailed account may be found in my above-named paper. Here (pl. 2) I add some figures, all drawn with the same degree of enlargement, of the anterior legs of specimens taken together in the Woods Hole region. Figure 2*a* shows the major part of the two anterior right thoracic legs of an adult male measuring 17 mm. It will be observed that the leg of the first pair has the joints figured even slightly shorter and not at all thicker than those of the second leg; but one small difference between the two legs is important: The seventh joint of the first leg is somewhat shorter, with considerably shorter and a little stronger setae than that of the second leg, while in specimens of forma *Rhoda* the seventh joint of the first leg is similar to that of the second leg. Figure 2*b* shows the same parts of the corresponding left legs of another adult male, 16.5 mm. long. In this specimen the first leg has the fourth joint conspicuously thicker than in the second leg. Furthermore, the fifth joint is slightly thickened, a little elongate, conspicuously curved, and with the naked proximal part longer than in the second leg; the sixth joint of the first leg is distinctly thicker than that of the second leg; the seventh joint of the first leg is considerably shorter and much broader than that of the second leg, only slightly longer than broad and with its setae thicker, somewhat spine-shaped, and much shorter than on the second leg. Figure 2*c* represents the two distal joints of the first left leg of a large female, 22.5 mm. long. The seventh joint is intermediate between those in the two preceding figures. Figure 2*d* represents the first left leg of an adult female, 19 mm. long. This leg shows the full *Thysanoessa*-development. Its fourth joint reaches forward to a little before the end of the second antennular joint, and a comparison between figure 2*d* and figures 2*a*–2*b* shows the great differences in thickness, length, and equipment with setae or spines among legs of the first pair in different degrees of *Thysanoessa*-development in adult specimens. Finally, it

must be added that in specimens with the first pair of legs enormously elongate and thickened the legs of the second pair are in all respects similar to those shown in figures 2*a* and 2*b*. Stages between those shown in figures 2*b* and 2*d* have been omitted as unnecessary.

Distribution.—In the *Ingolf* Malacostraca (vol. 1, 1908) I had put together our knowledge of the distribution of *Rhoda inermis* and *Thysanoessa neglecta*; in Grønlands Krebsdyr og Pycnogonider (1913) K. Stephensen has added several statements. A brief abstract may be given here. It is known from the Gulf of St. Lawrence and was taken in a line between southeastern Newfoundland and Cape Farewell. Along west Greenland it goes northward to lat. $70\frac{1}{2}^{\circ}$ N., at east Greenland northward to lat. $78^{\circ} 13\frac{1}{2}'$ N. Furthermore, it is known from Iceland, the Faroes, Scotland, the western end of the Channel, the North Sea, Skager Rak, and northern Kattegat. It is extremely common on the northern coast of Norway and has been caught at Spitzbergen, in the Kara Sea, and at Franz Joseph Land. The list of localities above gives our information on its occurrence in the North Pacific and Bering Sea.

30. THYSANOESSA RASCHII M. Sars (1863).

1882. *Euphausia raschii* G. O. Sars, Overs. Vid. Selsk. Forh. Christiania for 1882, No. 18, p. 51.

1909. *Rhoda raschii* ZIMMER, Nord. Plankton, Schizopoden, p. 11, figs. 13-14.

1911. *Thysanoëssa raschii* H. J. HANSEN, Bull. l'Inst. Océan. Monaco, No. 210., pp. 38 and 42.

Occurrence.—Of this species material is at hand from Davis Strait, from a goodly number of places in the northwest Atlantic, and from several places in Bering Sea and the North Pacific.

A. Atlantic localities.

Off west coast of Greenland, at lat. $66^{\circ} 40'$ N. Greely Relief Expedition. H. G. Dresel. 2 specimens.

Grampus No. 648. August 3, 1894. Lat. $50^{\circ} 04' 15''$ N.; long. $63^{\circ} 29' 30''$ W. Tow-net. 1 specimen.

Grampus No. 638. August 1, 1894. Lat. $50^{\circ} 01' 15''$ N.; long. $65^{\circ} 33' 45''$ W. Tow-net. 1 specimen.

Grampus Nos. 640-641. August 2, 1894. About 50° N.; long. $65^{\circ} 08'$ W. Dip-net. 1 specimen.

Grampus. August 16, 1887. Mingan Island, near the northern coast of Gulf of St. Lawrence (about lat. 50° N.). Enormous number of specimens.

Grampus 629. July 30, 1894. Lat. $49^{\circ} 49' 15''$ N.; long. $64^{\circ} 38'$ W. Tow-net. 3 specimens.

Grampus. July 30, 1894. About lat. $49^{\circ} 49'$ N.; long. $64^{\circ} 38'$ W. From the well of the schooner. Half pint of specimens.

Grampus No. 628. July 30, 1894. Lat. $49^{\circ} 46' 45''$ N.; long. $64^{\circ} 34'$ W. Tow-net. Large number of specimens.

Grampus No. 627. July 29, 1894. Lat. $49^{\circ} 45' 43''$ N.; long. $64^{\circ} 31' 30''$ W. Tow-net. 9 specimens.

Grampus No. 626. July 29, 1894. Lat. $49^{\circ} 43' 30''$ N.; long. $64^{\circ} 24'$ W. Tow-net. Numerous specimens.

Grampus. July 7, 1887. 7 miles SSE. from Cape Pine, Newfoundland. 9 specimens.

Sta. 2468. July 3, 1885. Lat. $45^{\circ} 11' 30''$ N.; long. $55^{\circ} 51' 30''$ W. 1 specimen.

Sta. 2699. August 22, 1886. Lat. $45^{\circ} 04'$ N.; long. $55^{\circ} 23'$ W. 2 specimens.

Sta. 41. August 20, 1877. Lat. $42^{\circ} 49'$ N.; long. $66^{\circ} 19'$ W. 1 specimen.

Sta. 1087. August 3, 1881. Cape Cod Light, SSW. 7 miles. 3 small specimens.

B. Localities in Bering Sea and North Pacific.

Sta. 3237. June 7, 1890. Lat. $58^{\circ} 08'$ N.; long. $158^{\circ} 19'$ W. Many specimens.

Sta. 4254. July 16, 1903. Chilkoot Inlet, southeastern Alaska (about lat. 58° ; long. 135° W.). 1 specimen.

Sta. 4753. October 1, 1905. Lat. $55^{\circ} 41' 30''$ N.; long. $131^{\circ} 46' 12''$ W. 2 specimens.

Sta. 3444. August 27, 1891. Lat. $48^{\circ} 16' 30''$ N.; long. $123^{\circ} 29' 40''$ W. 1 specimen.

April 5, 1913. From stomach of salmon caught between Tacoma and Seattle, Washington. C. H. Gilbert. Many specimens.

Sta. 5030. September 29, 1906. Lat. $46^{\circ} 29' 30''$ N.; long. $145^{\circ} 46'$ E. 300–0 fathoms. 3 specimens.

May 1, 1884. Lat. $39^{\circ} 25'$ N.; long. $150^{\circ} 28'$ W. Lieut. G. M. Stoney. 1 specimen.

Remarks.—It was impossible to find any difference between females from the Atlantic and the Pacific. Adult males from the Pacific are lacking.

Distribution.—This species is known from Christiania Fjord, Skager Rak, west coast of Norway, both sides of Scotland, Iceland, East Greenland at lat. $74\frac{1}{2}^{\circ}$ N. and along West Greenland northwards to lat. $70\frac{1}{2}^{\circ}$ N. It is interesting that it has not been taken south of Cape Cod.

31. *THYSANOESSA LONGICAUDATA* Krøyer (?1846).

1882. *Thysanoëssa tenera* G. O. Sars, Fork. Vid. Selsk. Christiania for 1882, No. 18, p. 53, pl. 1, figs. 19–20.

1905. *Thysanoëssa longicaudata* Holt and Tattersall, Rep. Fisheries of Ireland, 1902–1903, pt. 2, app. 2, pp. 107 and 138, pl. 15.

1911. *Thysanoëssa longicaudata* H. J. Hansen, Bull. l'Inst. Océan. Monaco, No. 210, pp. 38 and 41, fig. 13.

Occurrence.—The material at hand is extremely large, coming from 54 localities in the northwest Atlantic off the United States:

- Sta. 2528. July 13, 1885. Lat. $41^{\circ} 47' N.$; long. $65^{\circ} 37' 30'' W.$
1 specimen.
- Woods Hole region. Lat. $41^{\circ} 32' N.$ 3 specimens.
- Sta. 993. September 7, 1881. Lat. $40^{\circ} 28' N.$; long. $70^{\circ} 44' W.$
1 specimen.
- Sta. 2045. July 31, 1883. Lat. $40^{\circ} 04' 20'' N.$; long. $68^{\circ} 43' 50'' W.$ Large number of specimens.
- Sta. 2046. July 31, 1883. Lat. $40^{\circ} 02' 49'' N.$; long. $68^{\circ} 49' W.$
Numerous specimens.
- Sta. 2047. July 31, 1883. Lat. $40^{\circ} 02' 30'' N.$; long. $68^{\circ} 49' 40'' W.$ Numerous specimens.
- Sta. 1122. August 26, 1882. Lat. $40^{\circ} 02' N.$; long. $58^{\circ} 50' W.$ 4 specimens.
- Sta. 2091. September 21, 1883. Lat. $40^{\circ} 01' 50'' N.$; long. $70^{\circ} 59' W.$ 1 specimen.
- Sta. 2044. July 31, 1883. Lat. $40^{\circ} 00' 30'' N.$; long. $68^{\circ} 37' 20'' W.$ Many specimens.
- Sta. 1114. August 22, 1882. Lat. $39^{\circ} 58' N.$; long. $70^{\circ} 38' W.$
8 specimens.
- Sta. 1029. September 14, 1881. Lat. $39^{\circ} 57' 06'' N.$; long. $69^{\circ} 16' W.$ Numerous specimens.
- Sta. 1028. September 14, 1881. Lat. $39^{\circ} 57' N.$; long. $69^{\circ} 17' W.$ 5 specimens.
- Sta. 1031. September 14, 1881. Lat. $39^{\circ} 57' N.$; long. $69^{\circ} 19' W.$
Numerous specimens.
- Sta. 1035. September 14, 1881. Lat. $39^{\circ} 57' N.$; long. $69^{\circ} 28' W.$
Numerous specimens.
- Sta. 1034. September 14, 1881. Lat. $39^{\circ} 56' N.$; long. $69^{\circ} 26' W.$
4 specimens.
- Sta. 1093. August 11, 1882. Lat. $39^{\circ} 56' N.$; long. $69^{\circ} 45' W.$
Numerous specimens.
- Sta. 952. August 23, 1881. Lat. $39^{\circ} 55' N.$; long. $70^{\circ} 28' W.$ 1 specimen.
- Sta. 2188. August 3, 1884. Lat. $39^{\circ} 54' 30'' N.$; long. $71^{\circ} 08' W.$
15 specimens.
- Sta. 1096. August 11, 1882. Lat. $39^{\circ} 53' N.$; long. $69^{\circ} 47' W.$
Numerous specimens.
- Sta. 1026. September 8, 1881. Lat. $39^{\circ} 50' 30'' N.$; long. $71^{\circ} 23' W.$ 14 specimens.
- Sta. 2187. August 3, 1884. Lat. $39^{\circ} 49' 30'' N.$; long. $71^{\circ} 10' W.$
9 specimens.
- Sta. 2215. August 22, 1884. Lat. $39^{\circ} 49' 15'' N.$; long. $70^{\circ} 31' 45'' W.$ Many specimens.
- Sta. 2192. August 5, 1884. Lat. $39^{\circ} 46' 30'' N.$; long. $70^{\circ} 14' 45'' W.$ 1 specimen.

Sta. 2687. July 18, 1886. Lat. $39^{\circ} 46' N.$; long. $71^{\circ} 19' W.$
Many specimens.

Sta. 2195. August 5, 1884. Lat. $39^{\circ} 44' N.$; long. $70^{\circ} 03' W.$ 3
specimens.

Sta. 998. September 8, 1881. Lat. $39^{\circ} 43' N.$; long. $71^{\circ} 32' W.$
4 specimens.

Sta. 2093. September 21, 1883. Lat. $39^{\circ} 42' 50'' N.$; long.
 $71^{\circ} 01' 20'' W.$ 2 specimens.

Sta. 2029. May 25, 1883. Lat. $39^{\circ} 42' N.$; long. $70^{\circ} 47' W.$ Sur-
face. Surf. temp. 53° . 1 specimen.

Sta. 2689. July 18, 1886. Lat. $39^{\circ} 42' N.$; long. $71^{\circ} 15' 30'' W.$
Large number of specimens.

Sta. 997. September 8, 1881. Lat. $39^{\circ} 42' N.$; long. $71^{\circ} 32' N.$
11 specimens.

Sta. 2190. August 4, 1884. Lat. $39^{\circ} 40' N.$; long. $70^{\circ} 20' 15'' W.$
1 specimen.

Sta. 994. September 8, 1881. Lat. $39^{\circ} 40' N.$; long. $71^{\circ} 30' W.$
8 specimens.

Sta. 1137. September 8, 1882. Lat. $39^{\circ} 40' N.$; long. $71^{\circ} 52' W.$
Many specimens.

Sta. 2201. August 19, 1884. Lat. $39^{\circ} 39' 45'' N.$; long. $71^{\circ} 35' 15''$
 $W.$ 15 specimens.

Sta. 2690. July 18, 1886. Lat. $39^{\circ} 39' N.$; long. $71^{\circ} 11' W.$
Stomach of *Macrurus bairdii*. Many fragments.

Sta. 2202. August 19, 1884. Lat. $39^{\circ} 38' N.$; long. $71^{\circ} 39' 45''$
 $W.$ Many specimens.

Sta. 2205. August 20, 1884. Lat. $39^{\circ} 35' N.$; long. $71^{\circ} 18' 45''$
 $W.$ 3 specimens.

Sta. 2203. August 19, 1884. Lat. $39^{\circ} 34' 15'' N.$; long. $71^{\circ} 41'$
 $15'' W.$ 5 specimens.

Sta. 2683. July 17, 1886. Lat. $39^{\circ} 33' N.$; long. $70^{\circ} 50' W.$
Numerous specimens.

Sta. 2179. July 23, 1884. Lat. $39^{\circ} 30' 10'' N.$; long. $71^{\circ} 50' W.$
12 specimens.

Sta. 2180. July 23, 1884. Lat. $39^{\circ} 29' 50'' N.$; long. $71^{\circ} 49' 30''$
 $W.$ 6 specimens.

Sta. 2095. September 30, 1883. Lat. $39^{\circ} 29' N.$; long. $70^{\circ} 58'$
 $40'' W.$ Surface. Surf. temp. $69\frac{1}{2}^{\circ}$. Numerous specimens.

Sta. 2034. July 17, 1883. Lat. $39^{\circ} 27' 10'' N.$; long. $69^{\circ} 56' 20''$
 $W.$ 9 specimens.

Sta. 2041. July 30, 1883. Lat. $39^{\circ} 22' 50'' N.$; long. $68^{\circ} 25' W.$
1 specimen.

Sta. 2235. September 13, 1884. Lat. $39^{\circ} 12' N.$; long. $72^{\circ} 03'$
 $30'' W.$ 18 specimens.

Sta. 2222. September 6, 1884. Lat. $39^{\circ} 03' 15''$ N.; long. $70^{\circ} 50' 45''$ W. 10 specimens.

Sta. 2104. November 5, 1883. Lat. $38^{\circ} 48'$ N.; long. $72^{\circ} 40' 30''$ W. Enormous quantity of specimens.

Sta. 2230. September 12, 1884. Lat. $38^{\circ} 27'$ N.; long. $73^{\circ} 02'$ W. Many specimens.

Sta. 2565. August 28, 1885. Lat. $38^{\circ} 19' 20''$ N.; long. $60^{\circ} 02' 30''$ W. Many specimens.

Sta. 2172. July 20, 1884. Lat. $38^{\circ} 01' 15''$ N.; long. $73^{\circ} 44'$ W. 7 specimens.

Sta. 2097. October 1, 1883. Lat. $37^{\circ} 56' 20''$ N.; long. $70^{\circ} 57' 30''$ W. Surface. Surf. temp. $72\frac{1}{2}^{\circ}$. 1 specimen.

Sta. 2229. September 11, 1884. Lat. $37^{\circ} 48' 40''$ N.; long. $73^{\circ} 16' 30''$ W. Many specimens.

Grampus No. 28. April 27, 1887. Lat. $37^{\circ} 45'$ N.; long. $74^{\circ} 15'$ W. Tow-net. 1 specimen.

Sta. 2098. October, 1883. Lat. $37^{\circ} 40' 30''$ N.; long. $70^{\circ} 37' 30''$ W. 12 specimens.

Distribution.—*T. longicaudata* Krøyer is known from the eastern North Atlantic southward to the west coast of Ireland and the Skager Rak, furthermore it is widely distributed in the subarctic and Arctic seas north of the Atlantic, Europe and Asia eastward to lat. 80° N.; long. 124° E. More detailed information is given in the *Ingolf* Report, vol. 3, pt. 2, pp. 88–89 (1908); later Stephensen added a number of stations (1912).

32. THYSANOESSA PARVA H. J. Hansen (1905).

1905. *Thysanoëssa parva* H. J. HANSEN, Bull. Mus. Océan. Monaco, No. 30, p. 25, figs. 22–24.

1905. *Thysanoëssa parva* H. J. HANSEN, Bull. Mus. Océan. Monaco, No. 42, p. 27.

1911. *Thysanoëssa parva* H. J. HANSEN, Bull. l'Inst. Océan. Monaco, No. 210, pp. 39 and 43, fig. 14.

Occurrence.—The material is somewhat scanty, originating from only five places in the northwest Atlantic:

Sta. 2219. August 23, 1884. Lat. $39^{\circ} 46' 22''$ N.; long. $69^{\circ} 29'$ W. 16 specimens.

Sta. 2190. August 4, 1884. Lat. $39^{\circ} 40'$ N.; long. $70^{\circ} 20' 15''$ W. 10 specimens.

Sta. 2222. September 6, 1884. Lat. $39^{\circ} 03' 15''$ N.; long. $70^{\circ} 50' 45''$ W. 8 specimens.

Sta. 2230. September 12, 1884. Lat. $38^{\circ} 27'$ N.; long. $73^{\circ} 02'$ W. 1 specimen.

Sta. 2173. July 21, 1884. Lat. $37^{\circ} 57'$ N.; long. $72^{\circ} 34'$ W. 8 specimens.

Distribution.—*T. parva* was hitherto known only from the east Atlantic between about lat. $37\frac{1}{2}^{\circ}$ to $27\frac{3}{4}^{\circ}$ N.; all specimens were taken by the Prince of Monaco.

33. *THYSANOESSA GREGARIA* G. O. Sars (1883).

1885. *Thysanoëssa gregaria* G. O. Sars, *Challenger Rep.*, vol. 13, p. 120, pl. 21, figs. 8-17; pl. 22.

1905. *Thysanoëssa gregaria* H. J. HANSEN, *Bull. Mus. Océan. Monaco*, No. 42, pp. 27 and 28.

1911. *Thysanoëssa gregaria* H. J. HANSEN, *Bull. l'Inst. Océan. Monaco*, No. 210, pp. 39 and 43, fig. 15.

1913. *Thysanoëssa gregaria* H. J. HANSEN, *Rep. Crust. Schizopoda Swedish Antarctic Exp.*, p. 37, pl. 6, figs. 1a-1b.

Occurrence.—Material is at hand from four stations in the north-west Atlantic and from four places in the north Pacific:

A. *Atlantic stations.*—Sta. 2091. September 21, 1883. Lat. 40° 01' 50'' N.; long. 70° 59' W. 4 specimens.

Sta. 2095. August 5, 1883. Lat. 39° 44' N.; long. 70° 03' W. 2 specimens.

Sta. 2104. November 5, 1883. Lat. 38° 48' N.; long. 72° 40' 30'' W. 4 specimens.

Sta. 2098. October 1, 1883. Lat. 37° 40' 30'' N.; long. 70° 37' 30'' W. 4 specimens.

B. *Localities in the Pacific.*—Bering Island (about lat. 55° N.). Leonhard Stejneger, 1882-83. 1 specimen (female).

Sta. 4793. June 16, 1906. Lat. 54° 48' N.; long. 164° 54' E. Toperkoo Island, not far from Bering Island. 300-0 fathoms. 1 specimen (female).

May 1, 1884. Lat. 39° 25' N.; long. 150° 28' W. Lieut. G. M. Stoney, U. S. N. 1 specimen (adult male).

Sta. 4397. April 1, 1904. Lat. 33° 10' 15'' N.; long. 121° 42' 15'' W. 5 specimens (male).

Remarks.—As already stated by me in 1913,¹ this species varies considerably in several features, to which may be added that even the eyes seem to be somewhat variable in size. I have attempted, without success, to find differences in the shape of the processes of the copulatory organs of specimens from the North Pacific and the subantarctic ocean south of the Atlantic. The male taken by Lieutenant Stoney is 12 mm. long and has the eyes large.

Distribution.—This species is known from the temperate north Atlantic, the temperate south Atlantic, and southward in the subantarctic ocean to lat. 53° 34' S.; furthermore, from the south Pacific and the temperate and boreal north Pacific, but it has never been taken in the tropical area and, so far as I can see, perhaps not in the subtropical belts of any ocean. Further details on this topic may be found in the papers quoted above.

¹ *Rep. Crust. Schizopoda Swedish Antarctic Exp.*

Genus TESSARABRACHION H. J. Hansen.

Description.—Carapace with the frontal plate small, triangular, short and much broader than long (pl. 4, fig. 1*b*); a rostral process is wanting. Eyes very large, higher than broad, distinctly constricted not much above the middle (fig. 1*a*). Antennulæ (figs. 1*b*–1*d*) as in *Thysanoessa*; the first joint without distal lobe and very much broader than the two other peduncular joints, which are slender in the female (figs. 1*b* and 1*c*), while in the male the third joint especially is thicker; the upper flagellum depressed and shorter than the lower, which is compressed; both flagella broader in the male than in the female. Antennæ as in *Thysanoessa*; the peduncle of the endopod elongate (fig. 1*f*) with its proximal joint more than twice as long as the distal.

Maxillulæ (fig. 1*g*) with the pseudexopod and the palp moderately large. Maxilla (fig. 1*h*) very broad, both laciniae with the inner margin incised; fourth joint (4) short and somewhat small; exopod (*ex*) produced along the outer margin of fourth joint and terminating beyond its end. Endopod of the maxillipeds (figs. 1*a* and 1*i*) with the fourth joint extremely elongate, almost four times as long as the sum of the three distal joints, fifth and sixth joints being very short; the two distal joints are shown in figure 1*k*.

Thoracic legs (fig. 1*a*) about as in *Thysanoessa* excepting that both first and second pairs are very elongate, subsimilar; the structure of these legs is in the main like the first pair in a species of *Thysanoessa* where this pair is very elongate. The three following pairs with the full number of joints in the endopods; sixth pair with the exopod normally developed, while the endopod is in the female (fig. 1*l*) two-jointed, very slender, and slightly longer than the exopod, but wanting in the male. Seventh pair in both sexes without endopod, while the somewhat small exopod is one-jointed, styliform.

Abdomen as in *Thysanoessa*. All luminous organs are present.

Copulatory organs of first pleopods (fig. 1*m*) so reduced that I suppose that the males seen by me are not adult. The setiferous lobe and the auxiliary lobe with its hooks are well developed, while a median lobe is not marked off from the inner lobe, which has no processes but only two or three fine marginal spines.

Remarks.—This genus was established by me in 1911 on specimens of a single species found in the material of the United States National Museum. It differs from *Thysanoessa* in having no rostral process, while the two anterior pairs of thoracic legs are very elongate and subsimilar; furthermore, the structure of the maxillipeds differs much from that in *Thysanoessa* and all other genera.

34. TESSARABRACHION OCULATUM H. J. Hansen (1911).

Plate 4, figs. 1a-1m.

1911. *Tessarabrachion oculata* H. J. HANSEN, Bull. l'Inst. Océan. Monaco, No. 210, p. 47.

Occurrence.—It has been taken at three stations in the boreal Pacific:

Sta. 4793. June 16, 1906. Lat. $54^{\circ} 48' N.$; long. $164^{\circ} 54' E.$ Toperkoo Island, not far from Bering Island. 300-0 fathoms. 3 specimens (male, female).

Sta. 4759. May 20, 1906. Lat. $53^{\circ} 05' N.$; long. $138^{\circ} 31' W.$ 3 specimens.

Sta. 4806. June 26, 1906. Lat. $42^{\circ} 13' N.$; long. $144^{\circ} 21' E.$, off northern Japan. 200-0 fathoms. 9 specimens (male, female).

Description.—The small frontal plate (fig. 1b) has the apex subacute or a little rounded, and behind this end the plate is concave, which is due to the fact that the front marginal part of the carapace is above and thence downward below the middle of the sides, somewhat expanded, and bent respectively upward and outward as a kind of collar. The lateral margin of the carapace without any denticle.

The eyes are very large (figs. 1a-1b), considerably higher than broad, divided by a feeble constriction not much above the middle, and the upper section is nearly as broad as the lower.

Antennulæ in the female (figs. 1b and 1c) with the third peduncular joint slightly or scarcely longer but conspicuously more slender than the second; the lower flagellum is about as long as the sum of the two preceding joints, 17-jointed; the upper flagellum is about 15-jointed and slightly or considerably shorter. In the male (fig. 1d) the two distal peduncular joints are conspicuously thicker than in the female and the third at least as thick as the second; both flagella are somewhat longer than in the female, with about 17-18 joints in each flagellum. The antennal squama reaches in the female the middle of the third antennular joint; it is somewhat narrow (fig. 1f), with the outer margin concave and terminating in a denticle.

The two anterior pairs of legs are very elongate, the fourth joint reaching to or beyond the end of the antennular peduncle (fig. 1a), but this joint is comparatively feebly thickened and subcylindrical. The fifth joint is naked excepting two small spines on its distal portion, and it is more than two and a half times as long as the sum of the two distal joints. The sixth joint has about eight spiniform setæ along its prehensile margin and six or seven stiff setæ on the other margin. The seventh joint about as long as deep, with two somewhat long, curved spines and a few shorter spines; these spines are distinctly

longer on second than on first pair of legs. The setæ on third pair of legs not plumose.

The abdominal segments without dorsal denticles. Sixth segment about as long as the sum of the fourth and the fifth. The telson, which has two pairs of dorsal spinules, is nearly as long as the exopod of the uropods, and the exopod is somewhat shorter than the endopod.

Length.—The largest female is 24 mm., the largest male 20 mm. long.

Remarks.—In the description of the species I have not mentioned the copulatory organs; the reason is seen in the diagnosis of the genus, and the remarks to be found there, together with fig. 1*m*, may be sufficient.

Distribution.—Our entire knowledge of this topic is to be found above, under "Occurrence."

Genus NEMATOSCELIS G. O. Sars.

All six species hitherto established are represented in the collection.

35. NEMATOSCELIS MEGALOPS G. O. Sars (1883).

1885. *Nematoscelis megalops* G. O. Sars, *Challenger Rep.*, vol. 13, p. 127, pl. 23, figs. 5-10; pl. 24.

1911. *Nematoscelis megalops* H. J. Hansen, *Bull. l'Inst. Océan. Monaco*, No. 210, pp. 48-50, fig. 18A.

Occurrence.—This species is at hand from 47 places in the north-west Atlantic:

Sta. 69. September 1, 1877. Lat. 42° 44' N.; long. 62° 43' W.
1 specimen.

Sta. 1120. August 26, 1882. Lat. 40° 05' N.; long. 68° 48' W.
1 specimen.

Sta. 2045. July 31, 1883. Lat. 40° 04' 20'' N.; long. 68° 43' 50'' W. 9 specimens.

Sta. 2046. July 31, 1883. Lat. 40° 02' 49'' N.; long. 68° 49' W.
19 specimens.

Sta. 2047. July 31, 1883. Lat. 40° 02' 30'' N.; long. 68° 49' 40'' W. 4 specimens.

Sta. 1122. August 26, 1882. Lat. 40° 02' N.; long. 68° 50' W.
4 specimens.

Sta. 2044. July 31, 1883. Lat. 40° 00' 30'' N.; long. 68° 37' 20'' W. 3 specimens.

Sta. 2213. August 22, 1884. Lat. 39° 58' 30'' N.; long. 70° 30' W. 3 specimens.

Sta. 1114. August 22, 1882. Lat. 39° 58' N.; long. 30° 38' W.
1 specimen.

Sta. 2183. August 2, 1884. Lat. 39° 57' 45'' N.; long. 70° 56' 30'' W. 7 specimens.

Sta. 1029. September 14, 1881. Lat. $39^{\circ} 57' 06''$ N.; long. $69^{\circ} 10'$ W. 10 specimens.

Sta. 1028. September 14, 1881. Lat. $39^{\circ} 57'$ N.; long. $69^{\circ} 17'$ W. 5 specimens.

Sta. 1031. September 14, 1881. Lat. $39^{\circ} 57'$ N.; long. $69^{\circ} 19'$ W. 16 specimens.

Sta. 1035. September 14, 1881. Lat. $39^{\circ} 57'$ N.; long. $69^{\circ} 28'$ W. 1 specimen.

Sta. 952. August 23, 1881. Lat. $39^{\circ} 55'$ N.; long. $70^{\circ} 28'$ W. 7 specimens.

Sta. 2188. August 3, 1884. Lat. $39^{\circ} 54' 30''$ N.; long. $71^{\circ} 08'$ W. 1 specimen.

Sta. 1096. August 11, 1882. Lat. $39^{\circ} 53'$ N.; long. $69^{\circ} 47'$ W. 1 specimen.

Sta. 1026. September 8, 1881. Lat. $39^{\circ} 50' 30''$ N.; long. $71^{\circ} 23'$ W. 5 specimens.

Sta. 2187. August 3, 1884. Lat. $39^{\circ} 49' 30''$ N.; long. $71^{\circ} 10'$ W. 6 specimens.

Sta. 2215. August 22, 1884. Lat. $39^{\circ} 49' 15''$ N.; long. $70^{\circ} 31' 45''$ W. Many specimens.

Sta. 2192. August 5, 1884. Lat. $39^{\circ} 46' 30''$ N.; long. $70^{\circ} 14' 45''$ W. 3 specimens.

Sta. 2219. August 23, 1884. Lat. $39^{\circ} 46' 22''$ N.; long. $69^{\circ} 29'$ W. 7 specimens.

Sta. 2195. August 5, 1884. Lat. $39^{\circ} 44'$ N.; long. $70^{\circ} 03'$ W. 1 specimen.

Sta. 2689. July 18, 1886. Lat. $39^{\circ} 42'$ N.; long. $71^{\circ} 15' 30''$ W. 4 specimens.

Sta. 997. September 8, 1881. Lat. $39^{\circ} 42'$ N.; long. $71^{\circ} 32'$ W. 1 specimen.

Sta. 995. September 8, 1881. Lat. $39^{\circ} 40' 30''$ N.; long. $71^{\circ} 31'$ W. 1 specimen.

Sta. 2190. August 4, 1884. Lat. $39^{\circ} 40'$ N.; long. $70^{\circ} 20' 15''$ W. 3 specimens.

Sta. 994. September 8, 1881. Lat. $39^{\circ} 40'$ N.; long. $71^{\circ} 30'$ W. 6 specimens.

Sta. 1137. September 8, 1882. Lat. $39^{\circ} 40'$ N.; long. $71^{\circ} 52'$ W. 17 specimens.

Sta. 2201. August 19, 1884. Lat. $39^{\circ} 39' 45''$ N.; long. $71^{\circ} 35' 15''$ W. 10 specimens.

Sta. 2202. Aug. 19, 1884. Lat. $39^{\circ} 38'$ N.; long. $71^{\circ} 39' 45''$ W. 3 specimens.

Sta. 2203. August 19, 1884. Lat. $39^{\circ} 34' 15''$ N.; long. $71^{\circ} 41' 15''$ W. 9 specimens.

Sta. 2042. July 30, 1883. Lat. $39^{\circ} 33'$ N.; long. $68^{\circ} 26' 45''$ W. 1 specimen.

Sta. 2683. July 17, 1886. Lat. $39^{\circ} 33' N.$; long. $70^{\circ} 50' W.$ 8 specimens.

Sta. 1144. September 8, 1882. Lat. $39^{\circ} 31' N.$; long. $72^{\circ} 06' W.$ 1 specimen.

Sta. 2179. July 23, 1884. Lat. $39^{\circ} 30' 10'' N.$; long. $71^{\circ} 50' W.$ 1 specimen.

Sta. 2095. September 30, 1883. Lat. $39^{\circ} 29' N.$; long. $70^{\circ} 58' 40'' W.$ Surface. Surf. temp. $69\frac{1}{2}^{\circ}$. 16 specimens.

Sta. 2182. July 23, 1884. Lat. $39^{\circ} 25' 30'' N.$; long. $71^{\circ} 44' W.$ 1 specimen.

Sta. 2235. September 13, 1884. Lat. $39^{\circ} 12' N.$; long. $72^{\circ} 03' 30'' W.$ 10 specimens.

Sta. 2236. September 13, 1884. Lat. $39^{\circ} 11' N.$; long. $72^{\circ} 08' 30'' W.$ Numerous specimens.

Sta. 2104. November 5, 1883. Lat. $38^{\circ} 48' N.$; long. $72^{\circ} 40' 30'' W.$ 6 specimens.

Sta. 2203. September 12, 1884. Lat. $38^{\circ} 27' N.$; long. $73^{\circ} 02' W.$ 9 specimens.

Sta. 2172. July 20, 1884. Lat. $38^{\circ} 01' 15'' N.$; long. $73^{\circ} 44' W.$ 2 specimens.

Sta. 2105. November 6, 1883. Lat. $37^{\circ} 50' N.$; long. $73^{\circ} 03' 50'' W.$ Surface. Surf. temp. 63° . 1 specimen.

Sta. 2098. October 1, 1883. Lat. $37^{\circ} 40' 30'' N.$; long. $70^{\circ} 37' 30'' W.$ 7 specimens.

Sta. 2229. September 11, 1884. Lat. $37^{\circ} 38' 40'' N.$; long. $73^{\circ} 16' 30'' W.$ 12 specimens.

Sta. 2728. October 25, 1886. Lat. $36^{\circ} 30' N.$; long. $71^{\circ} 33' W.$ Many specimens.

The animals from the Pacific recorded by Ortmann in 1894 as *N. megalops* G. O. Sars, I refer to the following species.

Remarks.—Sars has published a detailed description with numerous excellent figures of the female, but he had no male specimen. In the female the third peduncular joint of the antennulæ is a little longer and conspicuously thinner than the second joint, while in the adult male the third joint is a little shorter than, or at most about as long as, the second and much thicker than in the female, being as thick as the second joint, which also is a little shorter and distinctly thicker than in the other sex. In both sexes the frontal plate is a moderately small triangle conspicuously broader than long; in the female this plate terminates in a very long and very narrow, canaliculate and curved rostrum, which is totally wanting in the male. Yet in very rare cases the male with the copulatory organs seemingly well developed has a rostrum as the female, and I have seen a single female (from station 1137) without any rostrum from the tip of the frontal plate. The copulatory organs

have been dealt with in my above-quoted paper. Large females are 24–25 mm. long, males 18 mm.

Distribution.—The long list shows this species to be extremely common in the Atlantic off the United States between lat. 40° N. and $39\frac{1}{2}^{\circ}$ N., that it has been taken once at about lat. $42\frac{3}{4}^{\circ}$ N., several times between lat. $39\frac{1}{2}^{\circ}$ and $37\frac{1}{2}^{\circ}$ N., and once at lat. $36\frac{1}{2}^{\circ}$ N. In the *Ingolf* Malacostraca, vol. 1 (1908) I have dealt with the distribution of *N. megalops*. It has been taken as far north as South-west Iceland, in lat. 63° N., also east of Newfoundland, west of the Faroes and farther south in the eastern north Atlantic; it is unknown from the tropical and subtropical belts of the Atlantic, but found again at some places in the southern temperate Atlantic. I mentioned that the Copenhagen Museum possesses specimens from the southern part of the Indian Ocean, viz, at lat. $40^{\circ} 8' S.$, long. $52^{\circ} E.$; at lat. $38^{\circ} S.$, long. $62\frac{1}{2}^{\circ} E.$; and at lat. $40^{\circ} 41' S.$, long. $85^{\circ} 22' E.$, but as all specimens in question are females I am now unable to decide whether the specimens belong to *N. megalops* G. O. Sars or to the extremely similar *N. difficilis* H. J. Hansen, a species unknown to me in 1908.

36. NEMATOSCELIS DIFFICILIS H. J. Hansen (1911).

1911. *Nematoscelis difficilis* H. J. HANSEN, Bull. l'Inst. Océan. Monaco, No. 210, p. 48, fig. 18 B.

Occurrence.—Among the unnamed material specimens from two stations in the Pacific are at hand:

Sta. 4757. May 4, 1906. Lat. $39^{\circ} 18' N.$; long. $123^{\circ} 58' W.$ Off California. 8 specimens (1 male, 1 female, and 6 half-grown).

Sta. 4407. April 9, 1904. Off S. E. point of Santa Catalina Island, Gulf of California (about lat. $26^{\circ} N.$). 1 specimen (male).

Furthermore, the animals recorded by Ortmann in 1894 as *N. megalops* belong to this species:

Sur. 541. January 14, 1892. Lat. $35^{\circ} 25' 30'' N.$; long. $125^{\circ} 09' 30'' W.$ 300–0 fathoms. 1 specimen (male).

Sur. 540. January 14, 1892. Lat. $35^{\circ} 19' 30'' N.$; long. $125^{\circ} 21' 30'' W.$ 300–0 fathoms. 3 specimens (male and rudiments of 2 females).

Finally the specimens from two of the stations referred by Ortmann in 1894 with some doubt to *N. microps* belong to *N. difficilis*:

Off Guaymas, Gulf of California (about lat. $28^{\circ} N.$), 500–0 fathoms. 3 specimens (female).

Fifty miles south of Guaymas. 700–0 fathoms. 6 specimens (only 1 female adult).

Remarks.—The material is somewhat scarce and the majority of the specimens either poorly preserved or far from adult.

Nevertheless, I have had the good fortune to examine 4 adult and rather well-preserved males; I have inspected their copulatory

organs and found that they agree with one another and with my figure quoted. The differences pointed out between the copulatory organs of *N. megalops* from the North Atlantic and *N. difficilis* from the northeast Pacific are very easily seen and certainly so sharp, so important, and so constant that they are sufficient for separating *N. difficilis* from *N. megalops*. I have hitherto been unable to find any other character by which to distinguish the two species, and consequently I am unable to separate their females, but it may be possible that more detailed investigation of rich and well-preserved material will show small differences between the females.

The male from survey 541 has no rostrum and is 16.5 mm. long; the male from survey 540 has a long female rostrum and is 18 mm. The male from station 4407 has no rostrum and is about 19 mm.; the male from station 4757 has the rostrum rudimentary and is 19 mm. long. The largest female, from off Guaymas, is 22 mm. long.

Distribution.—Hitherto known only from the six stations recorded, all situated in the northeast Pacific, between lat. $39\frac{1}{2}^{\circ}$ N. and 26° N.

37. *NEMATOSCELIS ATLANTICA* H. J. Hansen (1910).

1910. *Nematoscelis atlantica* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 107.

Occurrence.—Material from only two places in the northwest Atlantic is at hand:

Sta. 2210. August 21, 1884. Lat. $39^{\circ} 37' 45''$ N.; long. $71^{\circ} 18' 45''$ W. 2 specimens.

Sta. 2565. August 28, 1885. Lat. $38^{\circ} 19' 20''$ N.; long. $60^{\circ} 02' 30''$ W. 3 specimens.

Remarks.—This species, established on material taken by the Prince of Monaco, will be described and figured in the report on that fine collection.

Distribution.—Previously known only from the warmer temperate area of the eastern North Atlantic.

38. *NEMATOSCELIS MICROPS* G. O. Sars (1883).

1910. *Nematoscelis microps* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 107, pl. 15, figs. 2a-2k.

1912. *Nematoscelis microps* H. J. HANSEN, *Mem. Mus. Comp. Zool.*, vol. 35, No. 4, p. 259, pl. 9, figs. 4a-4d; pl. 10, figs. 1a-1b.

Occurrence.—It has been taken at five places in the northwest Atlantic:

Sta. 2045. July 31, 1883. Lat. $40^{\circ} 04' 20''$ N.; long. $68^{\circ} 43' 50''$ W. 1 specimen (adult male).

Sta. 2195. August 5, 1884. Lat. $39^{\circ} 44'$ N.; long. $70^{\circ} 03'$ W. 1 specimen (adult male).

Sta. 2230. September 12, 1884. Lat. $38^{\circ} 27'$ N.; long. $73^{\circ} 02'$ W. 1 specimen.

Sta. 2172. July 20, 1884. Lat. $38^{\circ} 01' 15''$ N.; long. $73^{\circ} 44'$ W. 1 specimen.

Sta. 2151. April 10, 1884. Caribbean Sea. Lat. $15^{\circ} 28' 39''$ N.; long. $80^{\circ} 36'$ W. 1 specimen (immature male).

The animals recorded with some doubt by Ortmann in 1894 as *N. microps* G. O. Sars, do not belong to this species, but to *N. difficilis* H. J. Hansen (see above), *N. gracilis* H. J. Hansen, and *N. tenella* G. O. Sars.

Distribution.—I have seen specimens from the Atlantic, the Indian Ocean (*Siboga*), and the tropical east Pacific (the Harvard paper), but a more detailed general account must be postponed.

39. *NEMATOSCELIS GRACILIS* H. J. Hansen (1910).

1910. *Nematoscelis gracilis* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 109, pl. 15, figs. 3a-3g.

1912. *Nematoscelis gracilis* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 261, pl. 10, fig. 2a.

Occurrence.—No specimen was found among the unnamed material, but most of the specimens from the tropical east Pacific recorded in 1894 by Ortmann as *N. microps* G. O. Sars, belong to *N. gracilis*, and the same is the case with the specimens referred by him to *N. tenella* G. O. Sars:

Sta. 3416. April 11, 1891. Lat. $16^{\circ} 32' 30''$ N.; long. $90^{\circ} 42' 40''$ W. 300-0 fathoms. 1 specimen.

Lat. $12^{\circ} 34'$ N.; long. $97^{\circ} 21'$ W. 4 immature specimens. (Referred to *N. tenella* by Ortmann.)

Sta. 3414. April 8, 1891. Lat. $10^{\circ} 14'$ N.; long. $96^{\circ} 28'$ W. 200-0 fathoms. 1 specimen. 300-0 fathoms. 5 specimens.

Hyd. 2619. March 11, 1891. Lat. $7^{\circ} 31'$ N.; long. $78^{\circ} 42' 30''$ W. 1,000-0 fathoms. 1 specimen.

Sta. 3382. March 7, 1891. Lat. $6^{\circ} 21'$ N.; long. $80^{\circ} 41'$ W. 200 fathoms; closed part of Tanner net. Many specimens.

Hyd. 2627. March 25, 1891. Lat. $0^{\circ} 36'$ N.; long. $82^{\circ} 45'$ W. 1770-0 fathoms. 1 specimen.

Hyd. 2628. March 26, 1891. Lat. $0^{\circ} 13'$ S.; long. $84^{\circ} 52'$ W. 200-0 fathoms. 2 specimens.

Distribution.—This species was known from the Indian Archipelago (*Siboga*) and the tropical East Pacific (the Harvard paper); in 1912 Tattersall enumerated a number of places in the Indian Ocean.

40. *NEMATOSCELIS TENELLA* G. O. Sars (1883).

1910. *Nematoscelis tenella* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 110, pl. 15, figs. 4a-4m.

1912. *Nematoscelis tenella* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 263, pl. 10, figs. 3a-3c.

Occurrence.—Among the unnamed material is a single specimen from the northwest Atlantic:

Sta. 2565. August 28, 1885. Lat. $38^{\circ} 19' 20''$ N.; long. $60^{\circ} 02' 30''$ W. 1 specimen (male).

The following specimens from the tropical East Pacific referred by Ortmann in 1894 to *N. microps* belong to *N. tenella*:

Sta. 3414. April 8, 1891. Lat. $10^{\circ} 14' N.$; long. $96^{\circ} 28' W.$ 200–0 fathoms. 1 specimen.

Hyd. 2627. March 25, 1891. Lat. $0^{\circ} 36' N.$; long. $82^{\circ} 45' W.$ 1770–0 fathoms. 1 specimen.

Distribution.—The very wide distribution in the Atlantic, the Indian Ocean, and the Pacific has been dealt with in the Harvard paper; in 1912 Tattersall enumerated many localities in the Indian Ocean.

Genus NEMATOBACHION Calman.

Only one of the three species known is represented in the collection.

41. NEMATOBACHION FLEXIPES Ortmann (1893).

1912. *Nematobrachion flexipes* H. J. HANSEN, Mem. Mus. Comp. Zool., vol. 35, No. 4, p. 269, pl. 10, figs. 5a–5m.

Occurrence.—Only the specimens from the tropical East Pacific referred correctly by Ortmann in 1894 to his *Stylocheiron flexipes* are found in the collection.

Sta. 3382. March 7, 1891. Lat. $6^{\circ} 21' N.$; long. $80^{\circ} 41' W.$ 200 fathoms. Closed part of the Tanner net. 3 specimens.

Hyd. 2627. March 25, 1891. Lat. $0^{\circ} 36' N.$; long. $82^{\circ} 45' W.$ 1770–0 fathoms. 1 specimen.

Distribution.—*N. flexipes* is known from the Atlantic and the East Pacific; more details on this topic have been given in my paper quoted.

Genus STYLOCHEIRON G. O. Sars.

Nine species are known, and five are represented in the collection.

42. STYLOCHEIRON CARINATUM G. O. Sars (1883).

1885. *Stylocheiron carinatum* G. O. Sars, *Challenger* Rep., vol. 13, p. 137, pl. 26.

1910. *Stylocheiron carinatum* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 113, pl. 16, figs. 1a–1h.

Occurrence.—Among the unnamed material specimens are at hand from seven stations, four of which are in the northwest Atlantic and three in the North Pacific:

A. Atlantic Stations.

Sta. 2091. September 21, 1883. Lat. $40^{\circ} 01' 50'' N.$; long. $70^{\circ} 59' W.$ 1 specimen.

Sta. 1029. September 14, 1881. Lat. $39^{\circ} 57' 06'' N.$; long. $69^{\circ} 10' W.$ 1 specimen.

Sta. 2174. July 21, 1884. Lat. $38^{\circ} 15' N.$; long. $72^{\circ} 03' W.$ Surface. Surf. temp. 76° . 1 specimen.

Sta. 2224. September 18, 1884. Lat. $36^{\circ} 16' 30'' N.$; long. $68^{\circ} 21' W.$ 2 specimens.

B. Stations in the North Pacific.

Sur. 163. November 11, 1891. Lat. $30^{\circ} 31' 30''$ N.; long. $140^{\circ} 05' 30''$ W. 330–300 fathoms. Tanner net. 2 specimens.

Sur. 174. November 12, 1891. Lat. $29^{\circ} 38'$ N.; long. $142^{\circ} 17'$ W. 330–300 fathoms. Tanner net. 1 specimen.

Sur. 16. March 1, 1888. Lat. $4^{\circ} 21'$ N.; long. $81^{\circ} 59'$ W. Surface. Surf. temp. 74° . 4.45 a. m. Moonlight. 14 specimens.

Furthermore, the specimen from one of the stations enumerated in 1894 by Ortmann for *S. suhmii* G. O. Sars belongs to *S. carinatum*, viz.

Sta. 3388. March 9, 1891. Lat. $7^{\circ} 06'$ N.; long. $79^{\circ} 48'$ W. 400–0 fathoms. 1 specimen (adult male).

The two specimens from the Hawaiian Islands recorded by Ortmann in 1905 as *S. carinatum* have been correctly named and most of the other specimens from the same station belong to the same species:

Sta. 3801. March 19, 1902. Lat. $28^{\circ} 31'$ N.; long. $141^{\circ} 47'$ W. 120–100 fathoms. 17 specimens.

Finally the specimen recorded in 1905 by Ortmann as *S. suhmii* belongs in reality to *S. carinatum*, and the determination is easy because one of the prehensile legs is well preserved.

Sta. 3803. March 21, 1902. Lat. $25^{\circ} 39' 45''$ N.; long. $147^{\circ} 41' 45''$ W. 50 fathoms. 1 specimen.

Distribution.—*S. carinatum* is very widely distributed in the Atlantic, the Indian Ocean, and the Pacific. A detailed account is found in my Harvard paper (1912), and a large number of places in the Indian Ocean were recorded by Tattersall in 1912.

43. STYLOCHEIRON AFFINE H. J. Hansen (1910).

1910. *Stylocheiron affine* H. J. Hansen, *Siboga Exp.*, vol. 37, p. 118, pl. 16, figs. 4a–4d.

Occurrence.—The animals from two of the stations enumerated by Ortmann in 1894 for *S. suhmii* G. O. Sars belong to *S. affine*:

Lat. $12^{\circ} 34'$ N.; long. $97^{\circ} 21'$ W. 8 specimens.

Hyd. 2628. March 26, 1891. Lat. $0^{\circ} 13'$ S.; long. $84^{\circ} 52'$ W. 200–0 fathoms. 2 specimens.

The two specimens from station 3414, referred by Ortmann to "*S. suhmi*," are so poor that they are unrecognizable. The specimen from station Hyd. 2619 does not belong to that species but to the *longicorne* group, being either *S. affine* or *S. longicorne*.

Distribution.—*S. affine* is known from the Indian Archipelago and the tropical east Pacific.¹

44. STYLOCHEIRON ELONGATUM G. O. Sars (1883)

1885. *Stylocheiron elongatum* G. O. Sars, *Challenger Rep.*, vol. 13, p. 146, pl. 27, figs. 6–10.

Occurrence.—Only a single specimen is at hand.

Sta. 2224. September 8, 1884. Lat. $36^{\circ} 16' 30''$ N.; long. $68^{\circ} 21'$ W. 1 specimen.

¹ See my Harvard paper of 1912.

Distribution.—This species, which is known from the Atlantic, the Indian Ocean, and the Pacific, seems to be scarce in most areas. A more detailed account has been given in my Harvard paper. In 1912 Tattersall enumerated four stations in the Indian Ocean.

45. *STYLOCHEIRON ABBREVIATUM* G. O. Sars (1883).

1910. *Stylocheiron abbreviatum* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 122.

1912. *Stylocheiron abbreviatum* H. J. HANSEN, *Mem. Mus. Comp. Zool.*, vol. 35, No. 4, p. 280, pl. 11, figs. 5a-5f.

Occurrence.—Among the unnamed material only some few specimens are at hand, all from the Pacific:

Sur. 163. November 11, 1891. Lat. $30^{\circ} 31' 30''$ N.; long. $140^{\circ} 05' 30''$ W. 330-300 fathoms. Tanner net. 3 specimens.

Sta. 3801. March 19, 1902. Lat. $28^{\circ} 31'$ N.; long. $141^{\circ} 47'$ W. Hawaiian Islands. 120-100 fathoms. 3 specimens (among specimens of *S. carinatum*).

The specimen from Hyd. 2619, referred by Ortmann in 1894 to *S. abbreviatum*, belongs in reality to the *longicorne* group, but it is too mutilated for determination. The specimen from the Hawaiian Islands mentioned by Ortmann in 1905 was correctly determined:

Sta. 3803. March 21, 1902. Lat. $25^{\circ} 39' 45''$ N.; long. $147^{\circ} 41' 45''$ W. 50 fathoms. 1 specimen.

Distribution.—*S. abbreviatum* is known from the Atlantic, the Indian Ocean, and the Pacific. A detailed account may be looked for in my Harvard paper quoted, and in 1912 Tattersall added a locality in the Indian Ocean.

46. *STYLOCHEIRON MAXIMUM* H. J. Hansen (1908).

1908. *Stylocheiron maximum* H. J. HANSEN, *The Danish Ingolf* Exp., vol. 3, Crust. Malacost., I, p. 92.

1910. *Stylocheiron maximum* H. J. HANSEN, *Siboga* Exp., vol. 37, p. 121, pl. 16, figs. 6a-6d.

Occurrence.—This species is at hand from a single station in the northwest Atlantic and from two places in the tropical east Pacific:

Sta. 2667. May 5, 1886. Lat. $30^{\circ} 53'$ N.; long. $79^{\circ} 42' 30''$ W. 1 specimen.

Sta. 3414. April 8, 1891. Lat. $10^{\circ} 14'$ N.; long. $96^{\circ} 28'$ W. 200-0 fathoms. 1 specimen.

Hyd. 2619. March 11, 1891. Lat. $7^{\circ} 31'$ N.; long. $78^{\circ} 42' 30''$ W. 2 specimens.

Distribution.—*S. maximum* is widely distributed in the Atlantic, going northward to lat. $61^{\circ} 49'$ N.; long. $14^{\circ} 11'$ W. (*Ingolf* Exp.), and southward to the subantarctic area as far as lat. $49^{\circ} 56'$ S. (H. J. Hansen, 1913). Besides, it is known from the Indian Archipelago (*Siboga* Exp.) and the tropical east Pacific.

EXPLANATION OF PLATES.

PLATE 1.

Thysanopoda cornuta Illig.

Fig. 1a. Carapace (with the proximal part of left eye-stalk) of a large female, from the left side; $\times \frac{7}{8}$.

Euphausia pacifica H. J. Hansen.

Fig. 2a. Anterior part of an adult female (from station 4757), from above; $\times 9$.

2b. Distal part of first antennular joint and proximal part of second joint of the same female, from above; $\times 22$.

2c. Major part of left antennular peduncle of an adult male, from the left side; $\times 17$.

2d. Major part of left antennular peduncle of an adult female, from the left side; $\times 17$.

2e. Left copulatory organ of first pleopod of an adult male, unrolled and seen from behind; $\times 33$. *li*, inner lobe; *lm*, median lobe; *ls*, setiferous lobe; *lu*, auxiliary lobe.

2f. Inner and median (*lm*) lobes of the organ shown in fig. 2e, from behind; $\times 51$. *p*², terminal process; *f*, its foot; *h*, its heel; *p*³, proximal process; *p*⁴, lateral process.

2g. Inner and median lobes of left copulatory organ of another male, from the inner side; $\times 51$. The lettering as in fig. 2f.

Thysanoessa longipes Brandt.

Fig. 3a. Major part of left antennular peduncle of an adult female (from station 5030), from the outer side; $\times 12$.

3b. Major part of left antennular peduncle of an adult male (from station 5030), from the outer side; $\times 12$.

3c. Distal part of the endopod of left maxilliped of a female, from below; $\times 33$.

3d. Right sixth thoracic leg, branchia omitted, of a female, from behind; $\times 12$.

PLATE 2.

Thysanoessa longipes Brandt. (Continued.)

Fig. 1a. Anterior part of body with appendages of a scarcely adult female, from the left side; $\times \frac{1}{2}$.

1b. Anterior part of a female, from above; $\times 7$.

1c. The six abdominal segments—pleopods omitted—and the base of the caudal fan of a female from station 4793, from the left side; \times scarcely 6.

1d. Left copulatory organ of first pleopod of an adult male, unrolled and seen from behind; $\times 32$. *li*, inner lobe; *lm*, median lobe; *ls*, setiferous lobe; *lu*, auxiliary lobe.

1e. Inner and median lobes of the organ shown in fig. 1d, from behind; $\times 50$. *p*¹, spiniform process; *p*², terminal process; *p*³, proximal process; *p*⁴, lateral process.

Thysanoessa inermis Krøyer.

Fig. 2a. Major part of the two anterior right thoracic legs of an adult male, 17 mm. long (from Woods Hole region), from the outer side; $\times 16$.

2b. Major part of the two anterior left thoracic legs of an adult male, 16.5 mm. long (from Woods Hole region), from the outer side; $\times 16$.

2c. Sixth and seventh joints of left first thoracic leg of a large female, 22.5 mm. long (from Woods Hole region), from the outer side; $\times 16$.

2d. First left thoracic leg of an adult female, 19 mm. long (from Woods Hole region), from the outer side; $\times 16$.

PLATE 3.

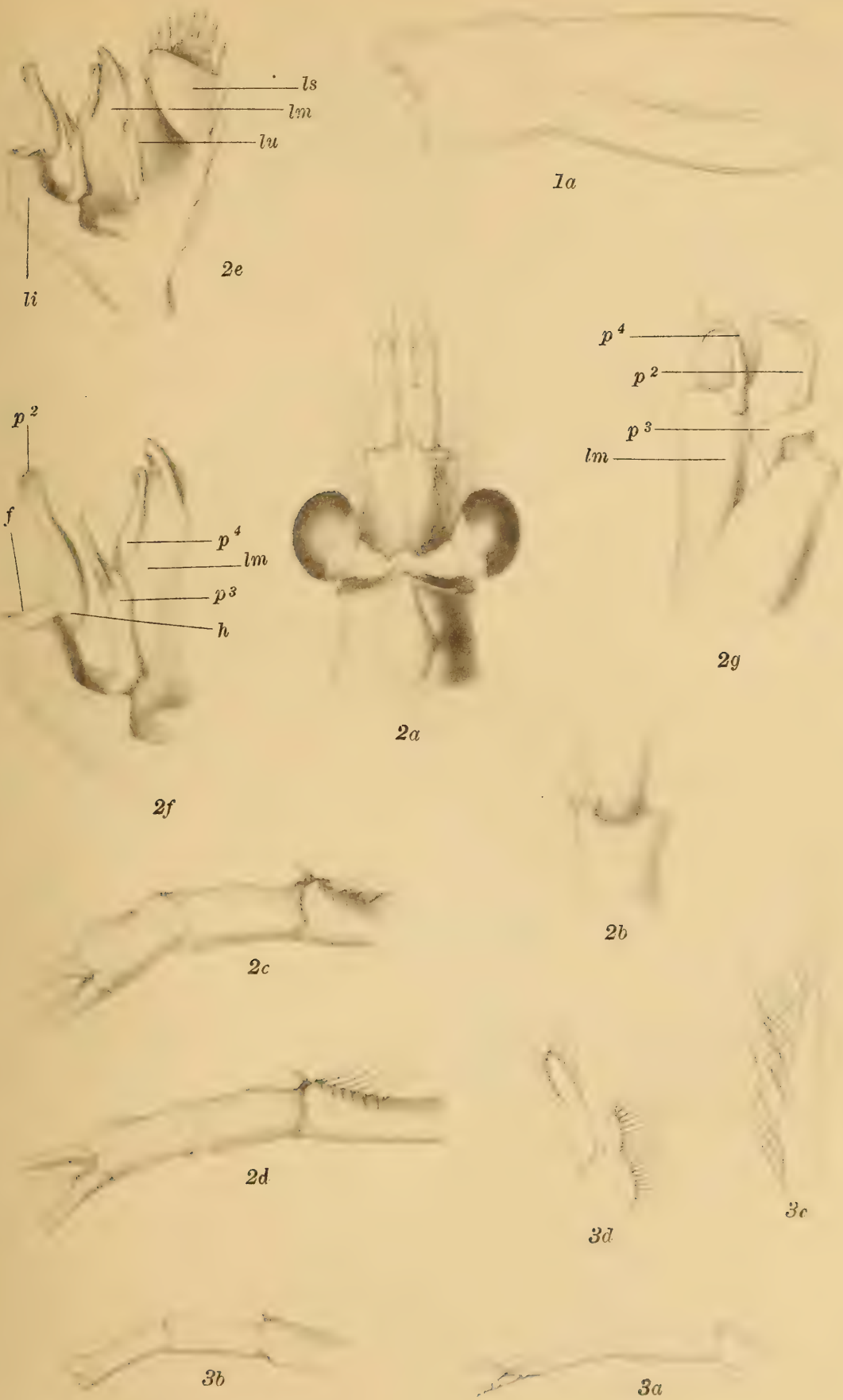
Thysanoessa spinifera Holmes.

- Fig. 1a. Anterior part of the body with appendages of an adult male (from station 4758), from the left side; $\times 6$.
- 1b. Anterior part of the body of an adult female (from Barclay Sound), from above; $\times \frac{1}{2}^5$.
- 1c. Major part of left antennular peduncle of a female, from the outer side; $\times 12$.
- 1d. Major part of left antennular peduncle of the male shown in fig. 1a, from the outer side; $\times 12$.
- 1e. Distal part of the endopod of left maxilliped of a female, from below; $\times 33$.
- 1f. Major part of the two anterior left thoracic legs of the adult male shown in fig. 1a, from the outer side; $\times 11$. *trl*¹, first leg; *trl*², second leg.
- 1g. The six abdominal segments—pleopods omitted—and the base of the caudal fan of a female (from station 4367), from the left side; \times scarcely 6.
- 1h. Left copulatory organ of first pleopod of a perhaps not fully adult male, unrolled and seen from behind; $\times 36$.
- 1i. Inner and median (*lm*) lobes of the organ shown in fig. 1h, from behind; $\times 80$. *p*¹, spiniform process; *p*², terminal process; *p*³, proximal process; *p*⁴, lateral process.
- 1k. The more important part of left copulatory organ of a large and adult male, from behind; $\times 61$. *lm*, median lobe; *ls*, setiferous lobe; *lu*, auxiliary lobe; the other letters as in fig. 1i.

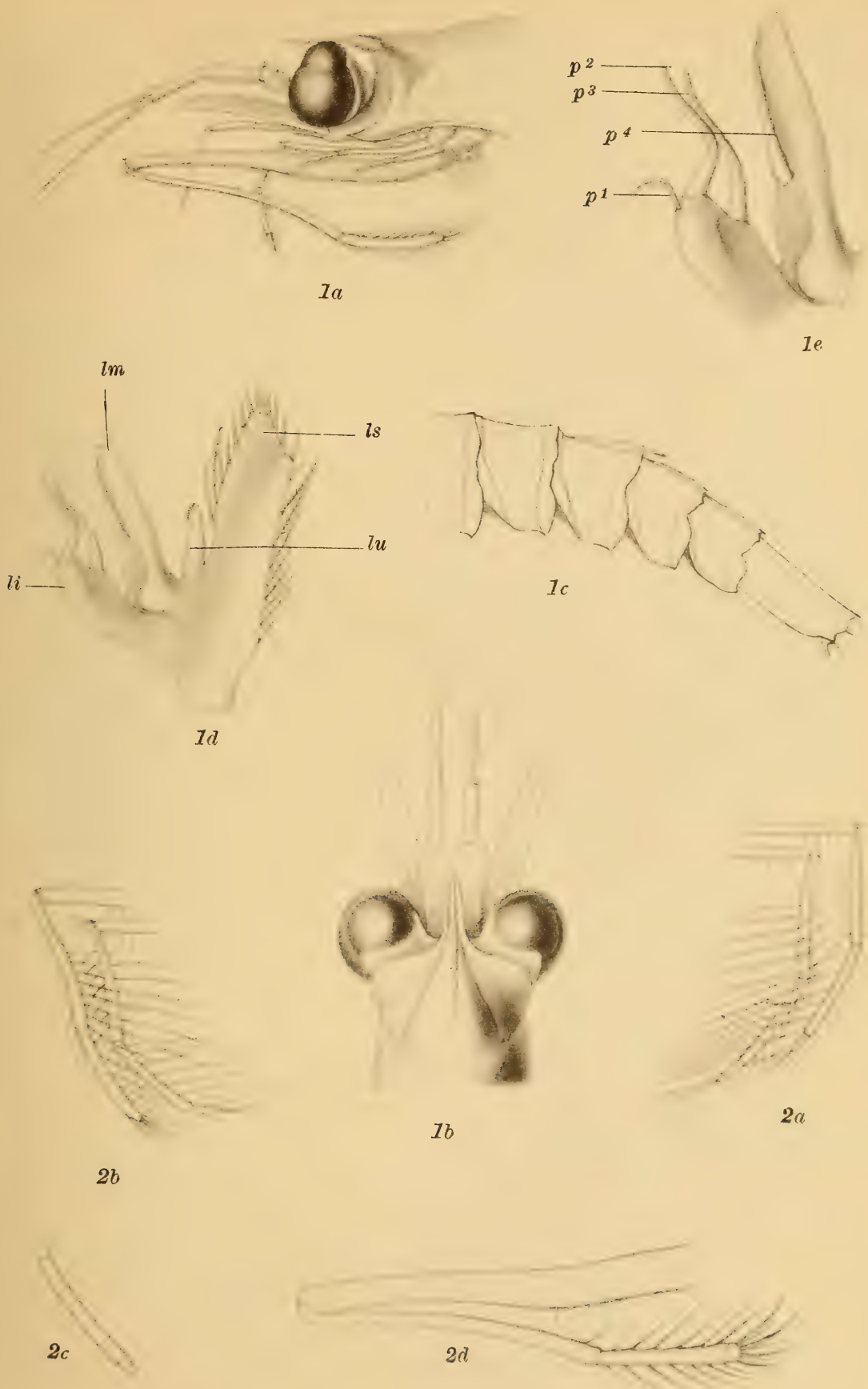
PLATE 4.

Tessarabrachion oculatum H. J. Hansen.

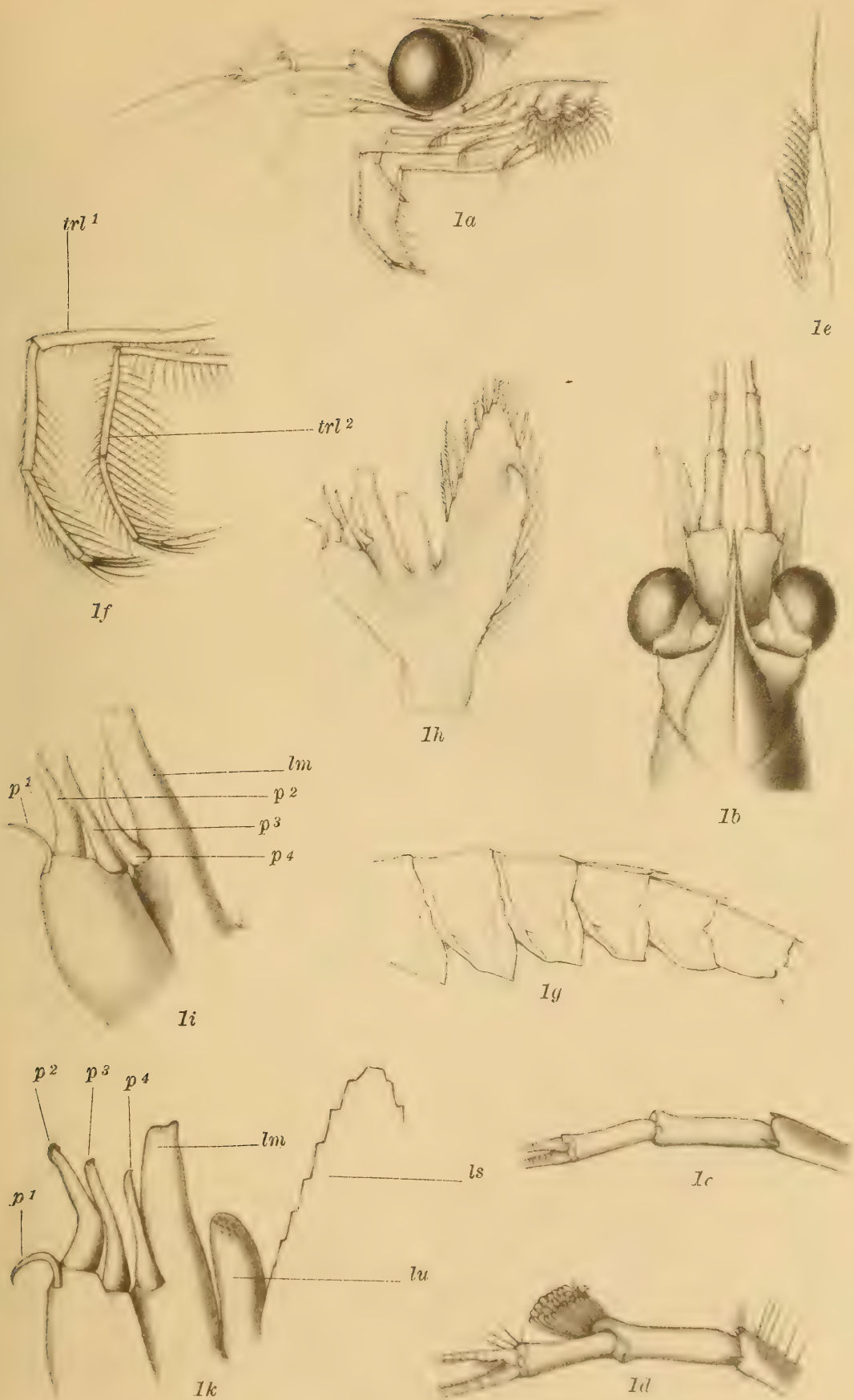
- Fig. 1a. Anterior part of the body with appendages of a male (from station 4793), from the left side; $\times 6$.
- 1b. Anterior part of a female (from station 4793), from above; $\times 7$.
- 1c. Left antennula, excepting the proximal part of first joint of a female, from the outer side; $\times 10$.
- 1d. Left antennula excepting the proximal part of first joint of a male, from the outer side; $\times 10$.
- 1e. Upper flagellum of left antennula of another male, from above; $\times \frac{2}{3}^5$.
- 1f. Right antenna, from below; $\times 7$.
- 1g. Left maxillula of a female, from below; $\times 30$.
- 1h. Left maxilla of the same female, from below; $\times 30$. 1, first joint; 2, second joint; 3, third joint; 4, fourth joint, "palp"; *ex*, exopod.
- 1i. Left maxilliped of a male, from below; $\times 9$.
- 1k. The terminal part of the maxilliped shown in fig. 1i, from below; $\times 33$.
- 1l. Right sixth thoracic leg, branchia omitted, of a female, from behind; $\times 14$.
- 1m. Left copulatory organ of first pleopod of a perhaps not adult male, unrolled and seen from behind; $\times 51$.



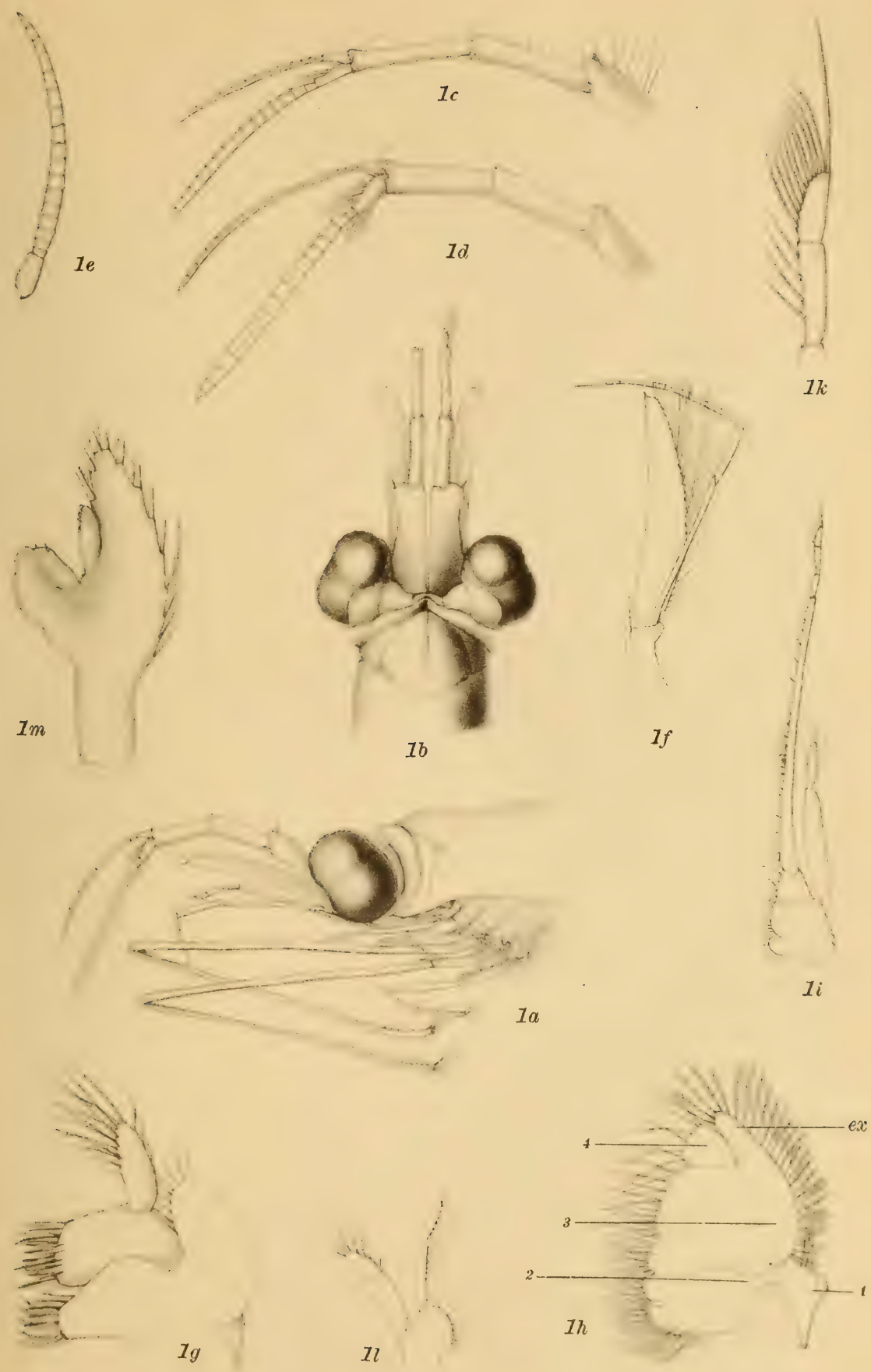
1. THYSANOPODA CORNUTA ILLIG 2. EUPHAUSIA PACIFICA H. J. HANSEN
3. THYSANOESSA LONGIPES BRANDT



1. THYSANOESSA LONGIPES BRANDT 2. T. INERMIS KRØYER



1. THYSANOESSA SPINIFERA HOLMES



1. TESSARABRACHION OCULATUM H. J. HANSEN

LIST OF GENERIC NAMES AND THEIR TYPE-SPECIES IN THE COLEOPTEROUS SUPERFAMILY SCOLYTOIDEA.¹

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INTRODUCTION.

The superfamily Scolytoidea is here proposed to include certain allied groups of genera of Coleoptera heretofore placed in the families Bostrichidæ by Erichson, 1836; Scolytidæ by Gemminger and Harold, 1872, and other authors to 1906; Ipidæ by Reitter, 1906, and Hagedorn, 1910, and Platypidæ by Chapuis, 1865.

In selecting the type-species of described genera and subgenera the author has been guided by the rules and recommendations of the International Commission on Zoological Nomenclature. In the case of the generic name *Scolytus* Geoffroy the advice of the local members of the commission, Drs. C. W. Stiles and Leonhard Stejneger, has been sought, and they have agreed that it is perfectly valid, with *Bostrichus scolytus* Fabricius, designated by Curtis, 1824, as the type.²

Types of genera were designated by Latreille, *Considérations Générales*, 1810; by Curtis, *British Entomology*, 1824 to 1839; by Lacordaire, *Histoire Naturelle des Insectes Coléoptères*, 1866; and in all cases where such designations conform to the present rules in mentioning "type" or "type of genus" they must be accepted unless otherwise barred by synonymy.

J. O. Westwood, in his *Synopsis of the Genera of British Insects*, 1840, mentions "typical" indigenous species which represent the genera, but it would appear that none of these can be accepted as the types of genera except when they have been so designated by subsequent authors. Therefore, such designations would date from the year in which the designations are made and not from the date of Westwood's publication. However, we are giving both the species cited by Westwood as typical species, as well as the first type fixation made after the date of Westwood.

No attempt is made in this list to indicate the synonyms and no distinction is made between generic and subgeneric names, but an

¹ This is a contribution toward a monograph of the scolytoid beetles. Other contributions published and in press are: Technical Series No. 17, Part 1 (published), Part 2 (in press), Bureau of Entomology, and Report No. 99 (in press), office of the Secretary, United States Department of Agriculture.

² See Technical Series No. 17, Part 2, Bureau of Entomology, for further evidence on this point.

effort has been made to include all of the generic and subgeneric names in the superfamily that have been published to December 2, 1912. Doubtless a few names have been overlooked which, with the help of other entomologists, may be included in supplementary lists.

ALPHABETIC LIST OF GENERIC NAMES.

The following list gives: 1, Generic names; 2, the author; 3, the original reference; 4, the type-species, the author of the species, and, if not monobasic, the authority for the designation; 5, the locality or country from which the type is described. If neither monobasic nor designated, the type is selected by the author of this list. Emendations, designated as Emend., are treated as other genera.

Acacis LEA.

Roy. Soc. Victoria, vol. 22, pt. 2 (new series), 1910, p. 149.

Type.—*Acacis abundus* LEA. Monobasic.

Australia.

Acanthophorus STROHMEYER.

Ent. Blätt., Jahrg. 6, 1910, p. 69. Name preoccupied.

Type.—*Acanthophorus brevicollis* STROHMEYER. Monobasic.

Usambara, German East Africa.

Acanthotomicus BLANDFORD.

Trans. Ent. Soc. London, 1894, p. 90.

Type.—*Acanthotomicus spinosus* BLANDFORD. Monobasic.

Japan.

Acanthurus EICHHOFF.

Notes Leyden Mus., vol. 8, 1886, p. 24. Two species.

Type.—*Acanthurus spinipennis* EICHHOFF.

Sumatra.

Acrantus BROWN.

Ann. Mag. Nat. Hist., ser. 5, vol. 9, 1882, p. 409. New name for *Homarus* Brown.

Type.—*Homarus mundulus* BROWN. Monobasic.

Wangarei Harbor, New Zealand.

Adiæretus HAGEDORN.

Deutsche Ent. Zeitschr., 1909, p. 744.

Type.—*Adiæretus spinosus* HAGEDORN. Monobasic.

Transvaal.

Allarthrum HAGEDORN.

Deutsche Ent. Zeitschr., 1912, p. 355.

Type.—*Allarthrum kolbei* HAGEDORN. Monobasic.

Peterhafen, German New Guinea.

Amphicranus ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 63.

Type.—*Amphicranus thoracicus* ERICHSON. Monobasic.

Brazil, South America.

Anæretus DUGÈS.

Ann. Ent. Soc. Belg., vol. 31, 1887, p. 141.

Type.—*Xyleborus guanajuatensis* DUGÈS. Monobasic.

Mexico.

Anchonocerus EICHHOFF.

Ratio Tom., 1879, p. 431.

Type.—*Anchonocerus rufipes* EICHHOFF. Monobasic.

New Granada.

Anisandrus FERRARI.

Borkenkäfer, 1867, p. 24.

Type.—*Xyleborus dispar* FABRICIUS. Monobasic.

Europe.

Aphanarthrum WOLLASTON.

Insecta Maderensia, 1854, p. 292.

Type.—*Aphanarthrum euphorbiæ* WOLLASTON. Monobasic.

Madeira.

Araptus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 15, 1871, p. 136.

Type.—*Araptus rufopalliatu*s EICHHOFF. Monobasic.

New Granada.

Aricerus BLANDFORD.

Ann. Soc. Ent. Belg., vol. 38, 1894, p. 134. Two species.

Type.—*Aricerus chapuisi* BLANDFORD.

Australia.

Blastophagus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 8, 1864, p. 25. Three species. Name preoccupied.

Type.—*Hylurgus piniperda* LINNÆUS (= *Dermestes piniperda* LINNÆUS). (Lacordaire, 1866).

Europe.

Bothrosternus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 12, 1868, p. 150.

Type.—*Bothrosternus truncatus* EICHHOFF. Monobasic.

Venezuela.

Bothryperus HAGEDORN.

Deutsche Ent. Zeitschr., 1909, p. 742.

Type.—*Bothryperus psalties* HAGEDORN. Monobasic.

Kamerun.

Brachyspartus FERRARI.

Borkenkäfer, 1867, p. 65.

Type.—*Brachyspartus moritzi* FERRARI. Monobasic.

Venezuela.

Cactopinus SCHWARZ.

Psyche, vol. 8, suppl. 1, 1899, p. 11.

Type.—*Cactopinus hubbardi* SCHWARZ. Monobasic.

Arizona.

Camptocerus DE JEAN.

Catalogue des Coléoptères, 1821, ed. 2, p. 100.

Type.—*Hylesinus æneipennis* FABRICIUS. Monobasic.

South America.

Carphoborus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 8, 1864, p. 27.

Type.—*Hylesinus minimus* FABRICIUS. Monobasic.

Middle Europe.

Cenocephalus CHAPUIS.

Monogr. des Platypides, 1865, p. 325.

Type.—*Cenocephalus thoracicus* CHAPUIS. Monobasic.

Rio de Janeiro, St. Catherine, Brazil.

Ceratolepis CHAPUIS.

Synops. Scol., 1869, p. 52; 1873, p. 260.

Type.—*Ceratolepis jucundus* CHAPUIS. Monobasic.

Nova Friburgo.

Chætophlœus LeConte.

Proc. Amer. Philos. Soc., vol. 15, 1876, p. 382.

Type.—*Hylesinus hystrix* LeConte. Monobasic.
California.

Chætophorus Fuchs.

Morphologische Studien über Borkenkäfer, 1912, p. 46.

Type.—*Hylesinus vestitus* Mulsant and Rey. Monobasic.
Hyères.

Chapuisia Dugès.

Ann. Soc. Ent. Belg., vol. 29, pt. 2, 1885, p. 58.

Type.—*Chapuisia mexicana* Dugès. Monobasic.
Mexico.

Chortastus Schaufuss.

Insekten-Börse, Jahrg. 22, 1905, p. 15.

Type.—*Chortastus camerunus* Schaufuss. Monobasic.
North Kamerun.

Chramesus LeConte.

Trans. Amer. Ent. Soc., vol. 2, 1868, p. 168.

Type.—*Chramesus hicoriæ* LeConte. Monobasic.
Columbia, Pennsylvania.

Cisurgus Reitter.

Bestimm. Tab., 1894, p. 65.

Type.—*Cisurgus filum* Reitter. Monobasic.
Russian Asia.

Cladoctonus Strohmeyer.

Ent. Blätt., Jahrg. 7, 1911, p. 17.

Type.—*Cladoctonus affinis* Strohmeyer. Monobasic.
Africa.

Cnemonyx Eichhoff.

Berlin. Ent. Zeitschr., vol. 12, 1868, p. 150.

Type.—*Cnemonyx galeritus* Eichhoff. Monobasic.
Chile.

Cnesinus LeConte.

Trans. Amer. Ent. Soc., vol. 2, 1868, p. 171.

Type.—*Cnesinus strigicollis* LeConte. Monobasic.
Illinois.

Cnestus Sampson.

Ann. Mag. Nat. Hist., ser. 8, vol. 7, 1911, p. 383.

Type.—*Cnestus magnus* Sampson. Monobasic.
Ceylon.

Coccotrypes Eichhoff.

Ratio Tom., 1879, p. 308. Six species.

Type.—*Bostrichus dactyliperda* Fabricius.
Africa and Asia.

Coptogaster Illiger.

Mag. Ins., vol. 6, 1807, p. 321. Eight species.

Type.—*Bostrichus scolytus* Fabricius.
Europe.

Coptonotus Chapuis.

Synops. Scol., 1869, p. 1i; 1873, p. 219.

Type.—*Coptonotus cyclopus* Chapuis. Monobasic.
New Granada.

Corthylomimus Ferrari.

Borkenkäfer, 1867, p. 48. Two species.

Type.—*Bostrichus fasciatus* Say.
Pennsylvania.

Corthylus ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 64.

Type.—*Bostrichus compressicornis* FABRICIUS. Monobasic.
Central America.

Cosmocorynus FERRARI.

Borkenkäfer, 1867, p. 62.

Type.—*Cosmocorynus cristatus* FERRARI. Monobasic.
Venezuela.

Cosmoderes EICHHOFF.

Ratio Tom., 1879, p. 495.

Type.—*Cosmoderus monilicollis* EICHHOFF. Monobasic.
Hindostan.

Craniodicticus BLANDFORD.

Ann. Mag. Nat. Hist., ser. 6, vol. 15, 1895, p. 317.

Type.—*Craniodicticus mucronatus* BLANDFORD. Monobasic.
Dikoya, Ceylon.

Crossotarsus CHAPUIS.

Monogr. des Platypides, 1865, p. 44. Twenty-nine species.

Type.—*Platypus wallacei* THOMSON.
Malacca (Singapore).

Cryphaloides FORMENEK.

Ent. Blätt., Jahrg. 4, 1908, p. 91.

Type.—*Cryphaloides donisthorpei* FORMENEK. Monobasic.
Kew, England.

Cryphalomorphus SCHAUFUSS.

Tijdschr. Ent., vol. 34, 1890, p. 12.

Type.—*Cryphalomorphus communis* SCHAUFUSS. Monobasic.
Madagascar.

Cryphalops REITTER.

Wiener Ent. Zeitschr., vol. 8, 1889, p. 94.

Type.—*Cryphalus lederei* REITTER. Monobasic.
Circassia.

Cryphalus ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 61. Three species.

Type.—*Bostrichus asperatus* GYLLENHAL (Thomson, 1859).
Europe.

Cryptarthrum BLANDFORD.

Trans. Ent. Soc. London, 1896, p. 200.

Type.—*Cryptarthrum walkeri* BLANDFORD. Monobasic.
Damma Island.

Crypturgus ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 60. Two species.

Type.—*Bostrichus pusillus* GYLLENHAL (Thomson, 1859).
Europe.

Ctenophorus CHAPUIS.

Synops. Scol., 1869, p. 49; 1873, p. 257.

Type.—*Ctenophorus lævigatus* CHAPUIS. Monobasic.
Columbia.

Ctonoxylon HAGEDORN.

Deutsche Ent. Zeitschr., 1910, p. 4. Three species.

Type.—*Ctonoxylon auratum* HAGEDORN.
Kamerun.

Cumatotomicus FERRARI.

Borkenkäfer, 1867, p. 44. Four species.

Type.—*Bostrichus stenographus* DUFTSCHMIDT.
Europe.

Cyclorhipidion HAGEDORN.

Deutsche Ent. Zeitschr., 1912, p. 355.

Type.—*Cyclorhipidion pelliculosum* HAGEDORN. Monobasic.
Kamerun.

Cylindra ILLIGER.

In Duftschmidt, Fauna Austriaca, vol. 3, 1825, p. 87.

Type.—*Cylindra platypus* ILLIGER. Monobasic.
Europe.

Cylindropalpus STROHMEYER.

Deutsche Ent. Nat.-Bib. No. 22, 1911, pl. 174.

Type.—*Cylindropalpus africanus* STROHMEYER. Monobasic.
Kamerun.

Cyrtogenius STROHMEYER.

Ent. Blätt., Jahrg. 7, 1911, p. 16. Emend. for *Kyrtogenius* Strohmeier.

Type.—*Kyrtogenius bicolor* STROHMEYER. Monobasic.
Africa.

Cyrtotomicus FERRARI.

Borkenkäfer, 1867, p. 44. Two species.

Type.—*Ips acuminatus* GYLLENHAL.
Europe.

Dacryostactus SCHAUFUSS.

Insekten-Börse, Jahrg. 22, 1905, p. 79.

Type.—*Dacryostactus kolbei* SCHAUFUSS. Monobasic.
Africa.

Dactylipalpus CHAPUIS.

Synops. Scol., 1869, p. 12; 1873, p. 220. Two species.

Type.—*Dactylipalpus transversus* CHAPUIS.
Celebes.

Dactylopselaphus GEMMINGER and HAROLD.

Cat. Coleop., 1872, p. 2678. New name for *Dactylipalpus* CHAPUIS. Two species.

Type.—*Dactylipalpus transversus* CHAPUIS.
Celebes.

Dendroctonus ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, pp. 52-53. Five species.

Type.—*Bostrichus micans* KUGELANN (Hopkins, 1909).

"Typical species."—*Dermestes piniperda* LINNÆUS (WESTWOOD, 1840).
Europe.

Dendrosinus CHAPUIS.

Synops. Scol., 1869, p. 28; 1873, p. 236.

Type.—*Hylesinus globosus* EICHHOFF. Monobasic.
North America.

Dendroterus BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, June, 1904, p. 233. Two species.

Type.—*Dendroterus mexicanus* BLANDFORD.
Mexico.

Dendrotrupes BROWN.

Man. New Zealand Coleop., vol. 2, 1881, p. 741. Two species.

Type.—*Dendrotrupes costiceps* BROWN.
Tairua, New Zealand.

Diamerus ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 57.

Type.—*Hylesinus hispidus* KLUG. Monobasic.
Madagascar.

Diapus CHAPUIS.

Monogr. des Platypides, 1865, p. 329. Four species.

Type.—*Diapus quadrispinatus* CHAPUIS.

India (Oriental).

Dolurgus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 12, 1868, p. 147.

Type.—*Hylastes pumilus* MANNERHEIM. Monobasic.

Alaska.

Dryocætes EICHHOFF.

Berlin. Ent. Zeitschr., vol. 8, 1864, p. 38. Four species.

Type.—*Bostrichus autographus* RATZEBURG.

Russia and Sweden.

Dryotomus CHAPUIS.

Synops. Scol., 1869, p. 46; 1873, p. 254.

Type.—*Dryotomus puberulus* CHAPUIS. Monobasic.

Cayenne:

Eccoptogaster HERBST.

Natursystem aller Insekten, Käfer, pt. 5, 1793, p. 124. Two species.

Type.—*Bostrichus scolytus* FABRICIUS.

Europe.

Eccoptopterus MOTSCHULSKY.

Bull. Mosc., vol. 36, No. 1, 1863, p. 515.

Type.—*Eccoptopterus sexspinosus* MOTSCHULSKY. Monobasic.

Ceylon.

Eidophelus EICHHOFF.

Ann. Soc. Ent. Belg., vol. 18, 1875, p. 200.

Type.—*Eidophelus imitans* Eichhoff. Monobasic.

Japan.

Elzearius GUILLEBEAU.

Ann. Soc. Ent., France, vol. 62, 1893, p. 64.

Type.—*Elzearius crenatus* GUILLEBEAU. Monobasic.

Northern Hungary.

Epomadius BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, Dec., 1897, p. 179.

Type.—*Epomadius culcitatus* BLANDFORD. Monobasic.

Panama.

Erineophilus HOPKINS.

Proc. Ent. Soc. Wash., vol. 5, 1903, p. 34.

Type.—*Erineophilus schwarzi* HOPKINS. Monobasic.

Florida.

Ernopus THOMSON.

Scand. Coleop., vol. 1, 1859, p. 147.

Type.—(*Bostrichus*) *tiliæ* PANZER. Monobasic.

Europe.

Ethadoselaphus BLANDFORD.

Ann. Mag. Nat. Hist., ser. 6, vol. 17, 1896, p. 321. Two species.

Type.—*Ethadoselaphus cicatricosus* BLANDFORD.

Natal.

Eulytocerus BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, Sept., 1897, p. 161.

Type.—*Eulytocerus championi* BLANDFORD. Monobasic.

Panama.

Eupagiocerus BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, June, 1896, p. 133.

Type.—*Eupagiocerus dentipes* BLANDFORD. Monobasic.

Guatemala.

Eurydactylus HAGEDORN.

Deutsche Ent. Zeitschr., 1909, p. 733. New name for *Platydactylus* Eichhoff.

Type.—*Platydactylus gracilipes* EICHHOFF. Monobasic.

Moluccas.

Ficicis LEA.

Roy. Soc. Victoria, vol. 22, pt. 2 (new ser.), 1910, p. 147. Two species.

Type.—*Ficicis varians* LEA.

New South Wales.

Genyocerus MOTSCHULSKY.

Etudes Ent., No. 7, 1858, p. 68.

Type.—*Genyocerus albipennis* MOTSCHULSKY. Monobasic.

Ceylon.

Glochinocerus BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, Nov., 1904, p. 266. Two species.

Type.—*Glochinocerus retusipennis* BLANDFORD.

Guatemala.

Glochiphorus STROHMEYER.

Ent. Blätt., Jahrg. 6, 1910, p. 126.

Type.—*Glochiphorus globosus* STROHMEYER. Monobasic.

Madagascar.

Glyptoderus EICHHOFF.

Ratio Tom., 1879, p. 137. Two species.

Type.—*Bostrichus binodulus* RATZEBURG.

Austria.

Gnathotrichus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 12, 1868, p. 275.

Type.—*Gnathotrichus corthyloides* EICHHOFF. Monobasic.

Carolina.

Gymnochilus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 11, 1867, p. 399.

Type.—*Gymnochilus zonatus* EICHHOFF. Monobasic.

Colombia.

Hapalogenius HAGEDORN.

Deutsche Ent. Zeitschr., 1912, p. 351.

Type.—*Hapalogenius globosus* HAGEDORN. Monobasic.

Pondo Land, Africa.

Hexacolus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 11, 1867, p. 399.

Type.—*Hexacolus glaber* EICHHOFF. Monobasic.

Cuba.

Holonthogaster GEMMINGER and HAROLD.

Cat. Coleop., 1872, p. 2676. Emend. for *Olonthogaster* Motschulsky. Two species.

Type.—*Olonthogaster nitidicollis* MOTSCHULSKY.

Ceylon.

Homarus BROWN.

Man. New Zealand Coleop., vol. 2, 1881, p. 740. Name preoccupied.

Type.—*Homarus mundulus* BROWN. Monobasic.

Wangarei Harbor, New Zealand.

Homœocryphalus LINDEMANN.

Bull. Mosc., vol. 51, No. 3, 1876, p. 168.

Type.—*Stephanoderes ehlersi* EICHHOFF. Monobasic.

Spain.

Hylastes ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 47. Two species.

Type.—*Bostrichus ater* PAYKULL (Westwood, 1840, and Thomson, 1859).

Europe.

Hylastinus BEDEL.

Faune Coleop. du Bassin de la Seine, 1888, p. 388.

Type.—*Dermestes obscurus* MARSHAM. Monobasic.

Locality unknown.

Hylastites HAGEDORN.

Schr. Phys.-Oekon. Ges. Königsberg, vol. 47, 1906, p. 117.

Type.—*Hylastites schellwieni* HAGEDORN. Monobasic.

East Prussia.

Hylesinities GERMAR.

Mag., vol. 1, 1813, p. 15.

Type.—*Hylesinities electrinus* GERMAR. Monobasic.

Europe.

Hylesinosoma LEA.

Roy. Soc. Victoria, vol. 22, pt. 2 (new ser.), 1910, p. 143.

Type.—*Hylesinus fici* LEA. Monobasic.

Australia.

Hylesinus FABRICIUS.

Syst. Eleu., vol. 2, 1801, p. 390.

Type.—*Hylesinus crenatus* FABRICIUS. Monobasic.

Europe.

Hylocurus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 15, 1871, p. 133.

Type.—*Hylocurus elegans* EICHHOFF. Monobasic.

Teapa, Mexico.

Hyloscyllus SCHAUFUSS.

Tijdschr. Ent., vol. 40, 1897, p. 218. Three species.

Type.—*Hyloscyllus exculptus* SCHAUFUSS.

Madagascar.

Hylurgops LeCONTE.

Proc. Amer. Philos. Soc., vol. 15, 1876, pp. 389-390. Four species.

Type.—*Hylastes pinifex* FITCH.

United States.

Hylurgus LATREILLE.

Gen. Crust. et Ins., vol. 2, 1807, p. 274.

Type.—*Bostrichus ligniperda* FABRICIUS. Monobasic.

Germany.

Hyorrhynchus BLANDFORD.

Trans. Ent. Soc. London, 1894, p. 60.

Type.—*Hyorrhynchus lewisi* BLANDFORD. Monobasic.

Sapporo, Japan.

Hypaspistes HAGEDORN.

Deutsche Ent. Zeitschr., 1908, p. 374. Name preoccupied.

Type.—*Hypaspistes camerunus* HAGEDORN. Monobasic.

Kamerun.

Hypoborus ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 62.

Type.—*Hypoborus ficus* ERICHSON. Monobasic.

Southern Europe.

Hypothenemus WESTWOOD.

Trans. Ent. Soc. London, vol. 1, 1834, p. 34.

Type.—*Hypothenemus eruditus* WESTWOOD. Monobasic.

Locality unknown.

Inosomus BROWN.

Ann. Mag. Nat. Hist., ser. 5, vol. 9, 1882, p. 409. New name for *Stenopus* BROWN.

Type.—*Stenopus rufopiceus* BROWN. Monobasic.

New Zealand.

Ips DEGEER.

Mem. Ins., vol. 5, 1775, p. 190. Eight species.

Type.—*Dermestes typographus* LINNÆUS.

Europe.

Kissophagus CHAPUIS.

Synops. Scol., 1869, p. 34; 1873, p. 242.

Type.—*Hylesinus hederæ* SCHMITT. Monobasic.

South Europe.

Kyrtogenius STROHMEYER.

Ent. Blätt., Jahrg. 6, 1910, p. 127.

Type.—*Kyrtogenius bicolor* STROHMEYER. Monobasic.

Africa.

Leiparthrum WOLLASTON.

Insecta Maderensia, 1854, p. 294. Four species.

Type.—*Leiparthrum bituberculatum* WOLLASTON (Wollaston, 1854).
Madeira.

Lepicerus EICHHOFF.

Ratio Tom., 1879, p. 501.

Type.—*Lepicerus aspericollis* EICHHOFF. Monobasic.

Burma, Asia.

Lepisomus KIRBY.

Bor. Amer., vol. 4, 1837, p. 193. Three species.

Type.—*Apate* (*Lepisomus*) *rufipennis* KIRBY.

Lat. 65° U. S.

Lissoclastus SCHAUFUSS.

Insekten-Börse, Jahrg. 22, 1905, p. 71.

Type.—*Lissoclastus pimeloides* SCHAUFUSS. Monobasic.

Kamerun.

Loganius CHAPUIS.

Synops. Scol., 1869, p. 52; 1873, p. 260.

Type.—*Loganius flavicornis* CHAPUIS. Monobasic.

Cumana.

Lymanitor LØVENDAL.

Ent. Med., vol. 2, 1889, p. 69.

Type.—*Lymanitor sepicola* LØVENDAL. Monobasic.

Denmark.

Meringopalpus HAGEDORN.

Bull. Mus., Paris, vol. 8, 1904, p. 547.

Type.—*Meringopalpus fallax* HAGEDORN. Monobasic.

Venezuela.

Mesoplatypus STROHMEYER.

Ent. Blätt., Jahrg. 8, 1912, p. 78.

Type.—*Mesoplatypus grandiclava* STROHMEYER. Monobasic.

French Kongo.

Mesoscolytus BROUN.

Ann. Mag. Nat. Hist., ser. 7, vol. 14, 1904, p. 125.

Type.—*Mesoscolytus inurbanus* BROUN. Monobasic.

New Zealand.

Metacorthylus BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, 1904, p. 263.

Type.—*Metacorthylus nigripennis* BLANDFORD. Monobasic.

Panama.

Micracis LECONTE.

Trans. Amer. Ent. Soc., vol. 2, 1868, p. 164. Two species.

Type.—*Micracis suturalis* LECONTE.

Illinois.

Microborus BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, 1897, p. 175.

Type.—*Microborus boops* BLANDFORD. Monobasic.

Guatemala.

Microcorthylus FERRARI.

Borkenkäfer, 1867, p. 58.

Type.—*Microcorthylus parvulus* FERRARI. Monobasic.

Venezuela.

Minulus EGGERS.

Ent. Blätt., Jahrg. 8, 1912, pp. 207–208.

Type.—*Minulus barbatus* EGGERS. Monobasic.

Crete.

Mitosoma CHAPUIS.

Monogr. des Platypides, 1865, p. 322.

Type.—*Mitosoma crenulatum* CHAPUIS. Monobasic.

Madagascar.

Monarthrum KIRSCH.

Berlin. Ent. Zeitschr., vol. 10, 1866, p. 213.

Type.—*Monarthrum chapuisi* KIRSCH. Monobasic.

Columbia.

Monebius, new name for *Nemobius* CHAPUIS, not SERVILE. Two species.

Type.—*Nemobius lambottei* CHAPUIS.

Teapa, Mexico.

Morizus FERRARI.

Borkenkäfer, 1867, p. 69.

Type.—*Morizus excisus* FERRARI. Monobasic.

Venezuela.

Myelophilites HAGEDORN.

Schr. Phys.-Oekon. Ges. Königsberg, vol. 47, 1906, p. 118.

Type.—*Myelophilites dubius* HAGEDORN. Monobasic.

East Prussia.

Myelophilus EICHHOFF.

Stett. Ent. Zeit., vol. 39, 1878, p. 400, footnote. Two species. New name for *Blastophagus*.

Type.—*Blastophagus piniperda* LINNÆUS (= *Dermestes piniperda* LINNÆUS).

Europe.

Nemobius CHAPUIS.

Synops. Scol., 1869, p. 41; 1873, p. 249 (not Serville, 1839). Two species.

Type.—*Nemobius lambottei* CHAPUIS.

Teapa, Mexico.

Nemophilus CHAPUIS.

Synops. Scol., 1869, p. 27; 1873, p. 235. Two species.

Type.—*Nemophilus strigillatus* CHAPUIS.

Texas.

Neotomicus FUCHS.

Morphologische Studien über Borkenkäfer, 1911, p. 38. Five species.

Type.—*Ips laricis* FABRICIUS.

Germany.

Notoplatypus LEA.

Roy. Soc. Victoria, vol. 22, pt. 2 (new ser.), 1910, p. 136.

Type.—*Notoplatypus elongatus* LEA. Monobasic.

New South Wales.

Olonthogaster MOTSCHULSKY.

Bull. Mosc., vol. 39, No. 1, 1866, p. 401. Two species.

Type.—*Olonthogaster nitidicollis* MOTSCHULSKY.

Ceylon.

Onthotomicus FERRARI.

Borkenkäfer, 1867, p. 44. Four species.

Type.—*Bostrichus laricis* FABRICIUS.

Europe.

Orthaspistes HAGEDORN.

Deutsche Ent. Zeitschr., 1909, p. 733. New name for *Hypaspistes* HAGEDORN.

Type.—*Hypaspistes camerunus* HAGEDORN. Monobasic.

Kamerun.

Ozopemon HAGEDORN.

Deutsche Ent. Zeitschr., 1908, p. 382.

Type.—*Ozopemon regius* HAGEDORN. Monobasic.

Sumatra.

Pachycotes SHARP.

Ent. Monthly Mag., vol. 14, 1877, p. 10.

Type.—*Pachycotes ventralis* SHARP. Monobasic.

New Zealand.

Pagiocerus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 12, 1868, p. 148. Two species.

Type.—*Pagiocerus rimosus* EICHHOFF.

Cuba.

Periommatatus CHAPUIS.

Monogr. des Platypides, 1865, p. 318.

Type.—*Periommatatus longicollis* CHAPUIS. Monobasic.

Cape of Good Hope.

Pernophorus STROHMEYER.

Ent. Blätt., Jahrg. 6, 1910, p. 92. New name for *Acanthophorus* STROHMEYER.

Type.—*Acanthophorus brevicollis* STROHMEYER. Monobasic.

Usambara, German East Africa.

Phlæoborus ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 54. Three species.

Type.—*Phlæoborus rudis* ERICHSON.

Brazil.

Phlæophthorus WOLLASTON.

Insecta Maderensia, 1854, p. 299.

Type.—*Phlæophthorus perfoliatus* WOLLASTON. Monobasic.

Madeira.

Phlæosinites HAGEDORN.

Schr. Phys.-Oekon. Ges., Königsberg, vol. 47, 1906, p. 119. Three species.

Type.—*Phlæosinites rehi* HAGEDORN.

East Prussia.

Phlæosinus CHAPUIS.

Synops. Scol., 1869, p. 37; 1873, p. 245. Eight species.

Type.—*Hylesinus thujæ* PERRIS.

France.

Phlæotribus LATREILLE.

Préc. Car. Gen. Ins., 1796, p. 50. Two species.

Type.—*Bostrichus oleæ* FABRICIUS (LATREILLE, 1810).

Middle Europe.

Phlæotrogus MOTSCHULSKY.

Bull. Mosc., vol. 1, 1863, p. 512.

Type.—*Phlæotrogus obliquecauda* MOTSCHULSKY. Monobasic.

Nuwara Eliya, Ceylon.

Phlæotrupes ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 53. Two species.

Type.—*Phlæotrupes grandis* ERICHSON.

Brazil.

Phrixosoma BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, August, 1897, p. 148.

Type.—*Phrixosoma rude* BLANDFORD. Monobasic.

Panama.

Phthorius EICHHOFF.

Ratio Tom., 1879, p. 433.

Type.—*Pterocyclon ingens* EICHHOFF. Monobasic.

Colombia.

Phthorophlæus REY.

Revue d'Ent., vol. 2, 1883, p. 128, footnote.

Type.—*Phlæophthorus spinulosus* REY. Monobasic.

Middle Europe.

Piezorhopalus GUÉRIN.

Revue Zool., 1838, p. 107.

Type.—*Piezorhopalus nitidulus* GUÉRIN. Monobasic.

Brazil.

Pityogenes BEDEL.

Faune Coleop. du Bassin de la Seine, 1888, pp. 397, 401. Three species.

Type.—*Dermestes chalcographus* LINNÆUS (BEDEL, 1888).

Europe.

Pityokteines FUCHS.

Morphologische Studien über Borkenkäfer, 1911, p. 37. Three species.

Type.—*Ips curvidens* GERMAR.

Saxony.

Pityophthorus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 8, 1864, p. 39. Two species.

Type.—*Bostrichus lichtensteini* RATZEBURG.

Northern Europe.

Platydactylus EICHHOFF.

Notes Leyd. Mus., vol. 8, 1886, p. 25. Name preoccupied.

Type.—*Platydactylus gracilipes* EICHHOFF. Monobasic.

Moluccas.

Platypus HERBST.

Natursystem aller Insekten, Käfer, No. 5, 1793, p. 128.

Type.—*Bostrichus cylindrus* FABRICIUS. Monobasic.

Germany.

Pæcilips SCHAUFUSS.

Berlin. Ent. Zeitschr., vol. 42, 1897, p. 110.

Type.—*Pæcilips sannio* SCHAUFUSS. Monobasic.

Sierra Leone.

Polygraphus ERICHSON.

Archiv für Naturgesch., Jahrg. 2, vol. 1, 1836, p. 57.

Type.—*Hylesinus pubescens* FABRICIUS (= *Dermestes polygraphus* LINNÆUS).
Monobasic.

Europe.

Premnobius EICHHOFF.

Ratio Tom., 1879, p. 404.

Type.—*Premnobius cavipennis* EICHHOFF. Monobasic.

Middle Africa.

Prionoceles BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, p. 6, Dec., 1897, p. 177. Two species.

Type.—*Prionoceles atratus* BLANDFORD.

Guatemala.

Problechilus EICHHOFF.

Ratio Tom., 1879, p. 167. Two species.

Type.—*Gymnochilus zonatus* EICHHOFF.

Colombia.

Progenius BLANDFORD.

Ann. Soc. Ent., France, vol. 45, 1896, p. 20. Two species.

Type.—*Progenius fleutiauxi* BLANDFORD.

Indo-China.

Pseudocorthylus FERRARI.

Borkenkäfer, 1867, p. 59. Four species.

Type.—*Pseudocorthylus letzneri* FERRARI.

Venezuela.

Pseudopolygraphus SEITNER.

Centralblatt für das gesammte Forstwesen, Jahrg. 37, No. 3, 1911, p. 100. Two species.

Type.—*Polygraphus grandiclava* THOMSON.

Europe.

Pseudothamnurgus EGGERS.

Ent. Blätt., Jahrg. 8, 1912, p. 115. Three species.

Type.—*Dryocætes mediterraneus* EGGERS.

Middle Europe.

Pteleobius BEDEL.

Faune Coleop. du Bassin de la Seine, 1888, p. 411. Two species.

Type.—*Bostrichus vittatus* FABRICIUS.

Locality unknown.

Pterocyclon EICHHOFF.

Berlin. Ent. Zeitschr., vol. 12, 1868, p. 277. Fifteen species.

Type.—*Pterocyclon laterale* EICHHOFF.

Mexico.

Pyncarthrum EICHHOFF.

Ratio Tom., 1879, p. 104. Two species.

Type.—*Pyncarthrum gracile* EICHHOFF.

Cuba.

Renocis CASEY.

Bull. Cal. Acad. Sci., vol. 2, 1886, p. 257.

Type.—*Renocis heterodoxus* CASEY. Monobasic.

Nevada.

Rhopalopleurus CHAPUIS.

Synops. Scol., 1869, p. 46; 1873, p. 254.

Type.—*Rhopalopleurus tuberculatus* CHAPUIS. Monobasic.

New Granada.

Rhopalopselion HAGEDORN.

Deutsche Ent. Zeitschr., 1909, p. 740.

Type.—*Rhopalopselion bituberculatum* HAGEDORN. Monobasic.
Kamerun.

Scierus LECONTE.

Proc. Amer. Philos. Soc., vol. 15, 1876, p. 390.

Type.—*Scierus annectens* LECONTE. Monobasic.

Anticosti Island, Gulf of St. Lawrence.

Scolytodes FERRARI.

Borkenkäfer, 1876, p. 77.

Type.—*Scolytodes lævigatus* FERRARI. Monobasic.

Colombia.

Scolytogenes EICHHOFF.

Ratio Tom., 1879, p. 497.

Type.—*Scolytogenes darwinii* EICHHOFF. Monobasic.

Hindustan; Burma.

Scolytomimus BLANDFORD.

Ann. Mag. Nat. Hist., ser. 6, vol. 15, 1895, p. 319.

Type.—*Scolytomimus dilutus* BLANDFORD. Monobasic.

Ceylon.

Scolytoplatypus SCHAUFUSS.

Tijdschr. Ent., vol. 34, 1890, p. 31.

Type.—*Scolytoplatypus permirus* SCHAUFUSS. Monobasic.

Madagascar.

Scolytopsis BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, May, 1896, p. 123.

Type.—*Scolytopsis puncticollis* BLANDFORD. Monobasic.

Guatemala.

Scolytus GEOFFROY.

Hist. d'Ins., 1762, p. 309. One species.

Type.—*Bostrichus scolytus* FABRICIUS (CURTIS, 1824).

Europe.

Spathidiceres CHAPUIS.

Monogr. des Platypides, 1865, p. 314.

Type.—*Spathidiceres thomsoni* CHAPUIS. Monobasic.

India.

Sphærotrypes BLANDFORD.

Trans. Ent. Soc. London, 1894, p. 61. Two species.

Type.—*Sphærotrypes pila* BLANDFORD.

Japan.

Spongocerus BLANDFORD.

Trans. Ent. Soc. Lond., 1893, p. 431. Three species.

Type.—*Scolytoplatypus tycon* BLANDFORD.

Japan.

Spongotarsus HAGEDORN.

Deutsche Ent. Zeitschr., 1908, p. 372.

Type.—*Spongotarsus quadrioculatus* HAGEDORN. Monobasic.

Sumatra.

Steganocranus EICHHOFF.

Ratio Tom., 1879, p. 460.

Type.—*Steganocranus dohrnii* EICHHOFF. Monobasic.

Central America.

Stenopus BROWN.

Man. New Zealand Coleop., 1881, p. 739. (Name preoccupied.)

Type.—*Stenopus rufopiceus* BROWN. Monobasic.

New Zealand.

Stephanoderes EICHHOFF.

Berlin. Ent. Zeitschr., vol. 15, 1871, p. 132. Seven species.

Type.—*Stephanoderes chapuisii* EICHHOFF.

North America.

Strombophorus HAGEDORN.

Deutsche Ent. Zeitschr., 1909, p. 740.

Type.—*Strombophorus crenatus* HAGEDORN. Monobasic.

Kamerun.

Styphlosoma BLANDFORD.

Biol. Centr.-Amer., Coleop, vol. 4, pt. 6, June, 1904, p. 232.

Type.—*Styphlosoma granulatum* BLANDFORD. Monobasic.

Panama.

Styracopterus BLANDFORD.

Ann. Mag. Nat. Hist., ser. 6, vol. 17, 1896, p. 323.

Type.—*Styracopterus murex* BLANDFORD. Monobasic.

South Africa.

Symmerus CHAPUIS.

Monogr. des Platypides, 1865, p. 319.

Type.—*Symmerus tuberculatus* CHAPUIS. Monobasic.

Guinea.

Tæniocerus BLANDFORD.

Trans. Ent. Soc. London, 1893, p. 437. Two species.

Type.—*Scolytplatypus mikado* BLANDFORD.

Japan.

Tænioglyptes BEDEL.

Faune Coleop. du Bassin de la Seine., 1888, p. 398. Two species.

Type.—*Bostrichus piceæ* RATZEBURG.

Europe.

Taphrorychus EICHHOFF.

Ratio Tom., 1879, p. 204. Four species.

Type.—*Bostrichus bicolor* HERBST.

Europe.

Tesserocerus SAUNDERS.

Trans. Ent. Soc. London, 1836, p. 155.

Type.—*Tesserocerus insignis* SAUNDERS. Monobasic.

Brazil.

Thamnurgus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 8, 1864, p. 40. Two species.

Type.—*Bostrichus euphorbiæ* KÜSTER.

South Europe.

Thysanoes LECONTE.

Rhynchophora of North America, 1876, p. 369.

Type.—*Thysanoes fimbriicornis* LECONTE. Monobasic.

Pennsylvania.

Tiarophorus SCHREINER.

Deutsche Ent. Zeitschr., vol. 26, 1882, p. 246.

Type.—*Tiarophorus elongatus* SCHREINER. Monobasic.

Guinea coast.

Tomicus LATREILLE.

Hist. Nat. Crust. et Ins., vol. 3, 1802, p. 203.

Type.—*Hylesinus piniperda* FABRICIUS (= *Dermestes piniperda* LINNÆUS). Monobasic.

Europe.

Triarmocerus EICHHOFF.

Ratio Tom., 1879, p. 119.

Type.—*Triarmocerus cryphaloides* EICHHOFF. Monobasic.

Madagascar.

Tricolus BLANDFORD.

Biol. Centr.-Amer., Coleop., vol. 4, pt. 6, June, 1905, p. 286. Two species.

Type.—*Tricolus ovicollis* BLANDFORD.

Guatemala.

Trigonogenius HAGEDORN.

Deutsche Ent. Zeitschr., 1912, p. 354.

Type.—*Trigonogenius fallax* HAGEDORN. Monobasic.

German East Africa.

Triotemnus WOLLASTON.

Cat. Canar. Coleop., 1864, p. 264.

Type.—*Triotemnus subretusus* WOLLASTON. Monobasic.

Gomera.

Trypocranus EICHHOFF.

Ratio Tom., 1879, p. 435.

Type.—*Trypocranus cincinnatus* EICHHOFF. Monobasic.

Bogota.

Trypodendron STEPHENS.

Ill. Brit. Ent., vol. 3, 1830, p. 353. Two species.

Type.—*Dermestes domesticum* LINNÆUS (WESTWOOD, 1840; THOMSON, 1859).

North and Middle Europe.

Trypophloeus FAIRMAIRE.

Genera Coleop. Europe, vol. 4, 1868, p. 105.

Type.—*Bostrichus binodulus* RATZEBURG. Monobasic.

Xestips HAGEDORN.

Deutsche Ent. Zeitschr., 1912, p. 353.

Type.—*Xestips marginatus* HAGEDORN. Monobasic.

East Africa.

Xyleborus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 8, 1864, p. 37. Six species.

Type.—*Bostrichus monographus* FABRICIUS.

Germany.

Xylechinites HAGEDORN.

Schr. Phys.-Oekon. Ges., Königsberg, vol. 47, 1906, p. 120.

Type.—*Xylechinites anceps* HAGEDORN. Monobasic.

East Prussia.

Xylechinus CHAPUIS.

Synops. Scol., 1869, p. 36; 1873, p. 244.

Type.—*Dendroctonus pilosus* KNOCH (not RATZEBURG). Monobasic.

Middle Europe.

Xylocleptes FERRARI.

Borkenkäfer, 1867, p. 37.

Type.—*Bostrichus bispinus* DUFTSCHMIDT. Monobasic.

Europe.

Xyloctonus EICHHOFF.

Berlin. Ent. Zeitschr., vol. 15, 1871, p. 134. Two species.

Type.—*Xyloctonus scolytoides* EICHHOFF.

Natal.

Xyloterus ERICHSON.

Archiv. für Naturgesch., Jahrg. 2, 1836, vol. 1, p. 60. Three species.

Type.—*Bostrichus lineatus* OLIVIER (THOMSON, 1859).

Northern Europe.

ALPHABETIC LIST OF THE NAMES OF THE TYPE-SPECIES UP TO
DECEMBER 2, 1912.

The following table includes: 1, Name of the type-species; 2, the name of its author; 3, the name of the genus in which the species was originally described, and 4, the name of the genus of which it is the type. When a species was originally placed in a genus of which it is the type, only one generic name is given. If a species is the type of more than one genus, the names of the genera are given with date of publication; as in *scolytus* and *piniperda*.

abundus Lea, *Acacicis*.
acuminatus Gyllenhal, (*Ips*) *Cyrtotomicus*.
aeneipennis Fabricius, (*Hylesinus*) *Camptocerus*.
affinis Strohmeier, *Cladoctonus*.
africanus Strohmeier, *Cylindropalpus*.
albipennis Motschulsky, *Genyocerus*.
anceps Hagedorn, *Xylechinites*.
annectens LeConte, *Scierus*.
asperatus Gyllenhal, (*Bostrichus*) *Cryphalus*.
aspericollis Eichhoff, *Lepicerus*.
ater Paykull, (*Bostrichus*) *Hylastes*.
atratus Blandford, *Prionoceles*.
auratum Hagedorn, *Ctonoxylon*.
autographus Ratzeburg, (*Bostrichus*) *Dryocætes*.
barbatus Eggers, *Minulus*.
bicolor Herbst, (*Bostrichus*) *Taphrorychus*.
bicolor Strohmeier, *Kyrtogenius* 1910.
bicolor Strohmeier, (*Kyrtogenius*) *Cyrtogenius*, 1911.
bispinus Duftschmidt, (*Bostrichus*) *Xylöcleptes*.
bituberculatum Wollaston, *Leiparthrum* or *Liparthrum* Authors.
bituberculatum Hagedorn, *Rhopalopselion*.
binodulus Ratzeburg, (*Bostrichus*) *Trypophlæus*, 1868.
binodulus Ratzeburg, (*Bostrichus*) *Glyptoderus*, 1879.
boops Blandford, *Microborus*.
brevicollis Strohmeier, *Acanthophorus*, March, 1910.
brevicollis Strohmeier, (*Acanthophorus*) *Pernophorus*, April, 1910.
camerunus Schaufuss, *Chortastus*.
camerunus Hagedorn, *Hypaspistes*, 1908.
camerunus Hagedorn, (*Hypaspistes*) *Orthaspistes*, 1909.
cavipennis Eichhoff, *Premnobiis*.
chalcographus Linnæus, (*Dermestes*) *Pityogenes*.
championi Blandford, *Eulytocerus*.
chapuisi Blandford, *Aricerus*.
chapuisi Kirsch, *Monarthrum*.

- chapuisii* Eichhoff, *Stephanoderes*.
cicatricosus Blandford, *Ethodopselaphus*.
cinnatus Eichhoff, *Trypocranus*.
communis Schaufuss, *Cryphalomorphus*.
compressicornis Fabricius, (*Bostrichus*) *Corthylus*.
corthyloides Eichhoff, *Gnathotrichus*.
costiceps Broun, *Dendrotrupes*.
crenatus Fabricius, *Hylesinus*.
crenatus Guillebeau, *Elzearius*.
crenatus Hagedorn, *Strombophorus*.
crenulatum Chapuis, *Mitosoma*.
cristatus Ferrari, *Cosmocorynus*.
cryphaloides Eichhoff, *Triarmocerus*.
culcitatus Blandford, *Epomadius*.
curvidens, Germar, (*Ips*) *Pityokteines*.
cyclopus Chapuis, *Coptonotus*.
cylindrus Fabricius, (*Bostrichus*) *Platypus*.
dactyliperda Fabricius (*Bostrichus*) *Coccotrypes*.
darwinii Eichhoff, *Scolytogenes*.
dentipes Blandford, *Eupagiocerus*.
dilutus Blandford, *Scolytomimus*.
dispar Fabricius, (*Xyleborus*) *Anisandrus*.
dohrnii Eichhoff, *Steganocranus*.
domesticum Linnæus, (*Dermestes*) *Trypodendron*.
donisthorpei Formenек, *Cryphaloides*.
dubius Hagedorn, *Myelophilites*.
ehlersi Eichhoff, (*Stephanoderes*) *Homæocryphalus*.
electrinus Germar, *Hylesinites*.
elegans Eichhoff, *Hylocurus*.
elongatus Schreiner, *Tiarophorus*.
elongatus Lea, *Notoplatypus*.
eruditus Westwood, *Hypothenemus*.
euphorbiæ Wollaston, *Aphanarthrum*.
euphorbiæ Küster, (*Bostrichus*) *Thamnurgus*.
excisus Ferrari, *Morizus*.
exsculptus Schaufuss, *Hyloscyllus*.
fallax Hagedorn, *Meringopalpus*.
fasciatus Say, (*Bostrichus*) *Corthylomimus*.
fici Lea, (*Hylesinus*) *Hylesinosoma*.
ficus Erichson, *Hypoborus*.
filum Reitter, *Cisurgus*.
fimbricornis LeConte, *Thysanoes*.
flavicornis Chapuis, *Loganius*.
fleutiauxi Blandford, *Progenius*.
galeritus Eichhoff, *Cnemonyx*.
glaber Eichhoff, *Hexacolus*.
globosus Eichhoff, (*Hylesinus*) *Dendrosinus*.
globosus Strohmeier, *Glochiphorus*.
gracile Eichhoff, *Pycnarthrum*.
gracilipes Eichhoff, *Platydactylus*, 1886.
gracilipes Eichhoff, (*Platydactylus*) *Eurydactylus*, 1909.
grandiclava Thomson, (*Polygraphus*) *Pseudopolygraphus*.
grandiclava Strohmeier, *Mesoplatypus*.
grandis Erichson, *Phlæotrupes*.

- granulatum* Blandford, *Styphlosoma*.
granulatus Ratzeburg, (*Bostrichus*) *Glyptoderus*.
guanajuatensis Dugès, (*Xyleborus*) *Anæretus*.
hederæ Schmitt, (*Hylesinus*) *Kissophagus*.
heterodoxus Casey, *Renocis*.
hicoloræ LeConte, *Chramesus*.
hispidus Klug, (*Hylesinus*) *Diamerus*.
hubbardi Schwarz, *Cactopinus*.
hystrix LeConte, (*Hylesinus*) *Chætophlæus*.)
imitans Eichhoff, *Eidophelus*.
ingens Eichhoff, (*Pterocyclon*) *Phthorius*.
insignis Saunders, *Tesserocerus*.
inurbanus Broun, *Mesoscolytus*.
jucundus Chapuis, *Ceratolepis*.
kolbei Schaufuss, *Dacryostactus*.
lævigatus Chapuis, *Ctenophorus*.
lævigatus Ferrari, *Scolytodes*.
lambottei Chapuis, *Nemobius* (not Serville, 1839).
lambottei Chapuis, (*Nemobius*) *Monebius*.
laricis Fabricius, (*Bostrichus*) *Onthotomicus*, 1867.
laricis Fabricius, (*Bostrichus*) *Neotomicus*, 1911.
laterale Eichhoff, *Pterocyclon*.
lederi Reitter, (*Cryphalus*) *Cryphalops*.
letzneri Ferrari, *Pseudocorthylus*.
lewisi Blandford, *Hyorrhynchus*.
lichtensteinii Ratzeburg, *Pityophthorus*.
ligniperda Fabricius, (*Bostrichus*) *Hylurgus*.
lineatus Olivier, (*Bostrichus*) *Xyloterus*.
longicollis Chapuis, *Periommatus*.
magnus Sampson, *Cnestus*.
major Strohmeier, *Crytogenius*.
mediterraneus Eggers, (*Dryocætes*) *Pseudothamnurgus*.
mexicana Dugès, *Chapuisia*.
mexicanus Blandford, *Dendroterus*.
micans Kugelann, (*Bostrichus*) *Dendroctonus*.
mikado Blandford, (*Scolytoplatypus*) *Tæniocerus*.
minus Fabricius, (*Hylesinus*) *Carphoborus*.
monographus Fabricius, (*Bostrichus*) *Xyleborus*.
moritzi Ferrari, *Brachyspartus*.
mucronatus Blandford, *Craniodicticus*.
mundulus Broun, *Homarus*, 1881.
mundulus Broun, (*Homarus*) *Acrantus*, 1882.
murex Blandford, *Styracopterus*.
nigripennis Blandford, *Metacorthylus*.
nitidicollis Motschulsky, *Olonthogaster*, 1866.
nitidicollis Motschulsky, (*Olonthogaster*) *Holonthogaster*, 1872.
nitidulus Guérin, *Piezorhopalus*.
obliquecauda Motschulsky, *Phlæotrogus*.
obscurus Marsham, (*Dermestes*) *Hylastinus*.
oleæ Fabricius, (*Bostrichus*) *Phlæotribus*.
ovicollis Blandford, *Tricolus*.
parvulus Ferrari, *Microcorthylus*.
perfoliatus Wollaston, *Phlæophthorus*.
permirus Schaufuss, *Scolytoplatypus*.

- piceæ* Ratzeburg, (*Bostrichus*) *Tænioglyptes*.
pila Blandford, *Sphærotrypes*.
pilosus Knoch, (*Dendroctonus*) *Xylechinus*.
pimeloides Schaufuss, *Lissoclastus*.
pinifex Fitch, (*Hylastes*) *Hylurgops*.
piniperda Linnæus, (*Dermestes*) *Tomicus*, 1802.
piniperda Linnæus, (*Dermestes*) *Dendroctonus*, 1840.
piniperda Linnæus, (*Dermestes*) *Blastophagus*, 1864.
piniperda Linnæus, (*Dermestes*) *Myelophilus*, 1878.
platypus Illiger, *Cylindra*.
polygraphus Linnæus, (*Dermestes*) *Polygraphus*.
psaltes Hagedorn, *Bothryperus*.
puberulus Chapuis, *Dryotomus*.
pumilus Mannerheim, (*Hylastes*) *Dolurgus*.
puncticollis Blandford, *Scolytopsis*.
pusillus Gyllenhal, (*Bostrichus*) *Crypturgus*.
quadrioculatus Hagedorn, *Spongotarsus*.
quadrispinatus Chapuis, *Diapus*.
regius Hagedorn, *Ozopemon*.
rehi Hagedorn, *Phlæosinites*.
retusipennis Blandford, *Glochinoscerus*.
rimosus Eichhoff, *Pagiocerus*.
rude Blandford, *Phrixosoma*.
rudis Erichson, *Phlæoborus*.
rustipennis Kirby, (*Apate*) *Lepisomus*.
rustipes Eichhoff, *Anchonocerus*.
*rufopalliatu*s Eichhoff, *Araptus*.
rufopiceus Broun, *Stenopus*, 1881.
rufopiceus Broun, (*Stenopus*) *Inosomus*, 1882.
sannio Schaufuss, *Pæcilips*.
schellwieni Hagedorn, *Hylastites*.
schwarzi Hopkins, *Erineophilus*.
scolytoides Eichhoff, *Xyloctonus*.
scolytus Fabricius, (*Bostrichus*) *Scolytus*, 1762.
scolytus Fabricius, (*Bostrichus*) *Eccoptogaster*, 1793.
scolytus Fabricius, (*Bostrichus*) *Coptogaster*, 1807.
sepicola Løvendal, *Lymanator*.
sexspinosus Motschulsky, *Eccoptogaster*.
spartii Chapuis, *Phlæophthorus*.
spinipennis Eichhoff, *Acanthurus*.
spinosus Blandford, *Acanthotomicus*.
spinosus Hagedorn, *Adiæretus*.
spinulosus Rey, (*Phlæophthorus*) *Phthorophlæus*.
stenographus Duftschmidt, (*Bostrichus*) *Cumatomicus*.
strigicollis LeConte, *Cnesinus*.
strigillatus Chapuis, *Nemophilus*.
subretusus Wollaston, *Triotemnus*.
suturalis LeConte, *Micracis*.
thomsoni Chapuis, *Spathidicerus*.
thoracicus Erichson, *Amphicranus*.
thoracicus Chapuis, *Cenocephalus*.
thujæ Perris, (*Hylesinus*) *Phlæosinus*.
tiliæ Panzer, (*Apate*) *Ernoporus*.
transversus Chapuis, *Dactylipalpus*, 1869.

- transversus* Chapuis, (*Dactylipalpus*) *Dactylopselaphus*.
truncatus Eichhoff, *Bothrosternus*.
tuberculatus Chapuis, *Rhopalopleurus*.
tuberculatus Chapuis, *Symmerus*.
tycon Blandford, *Spongocerus*.
typographus Linnæus, (*Dermestes*) *Ips*.
varians Lea, *Ficicis*.
ventralis Sharp, *Pachycotes*.
vestitus Mulsant and Rey, (*Hylesinus*) *Chætophorus*.
vittatus Fabricius, (*Bostrichus*) *Pteliobius*.
walkeri Blandford, *Cryptarthrum*.
wallacei Thomson, *Crossotarsus*.
zonatus Eichhoff, *Gymnochilus*, 1867.
zonatus Eichhoff, (*Gymnochilus*) *Problechilus*, 1879.
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A NEW GENUS AND SOME NEW SPECIES OF CRABS OF THE
FAMILY GONEPLACIDÆ.

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This is the second of a series of papers describing new crabs obtained in Philippine and adjacent waters during the years 1907-1910 by the steamer *Albatross* of the United States Bureau of Fisheries. The first paper was published as No. 2044 of these Proceedings.¹

The new forms here described are as follows:

<i>Carcinoplax bispinosa.</i>	<i>Ceratoplax fulgida.</i>
<i>Carcinoplax spinosissima.</i>	<i>Ceratoplax truncatifrons.</i>
<i>Carcinoplax confragosa.</i>	<i>Typhlocarcinus craterifer.</i>
<i>Carcinoplax purpurea.</i>	<i>Hepthopelta apta.</i>
<i>Carcinoplax angusta.</i>	<i>Chasmocarcinus cavimanus.</i>
<i>Carcinoplax verdensis.</i>	<i>Typhlocarcinops decrescens.</i>
<i>Carcinoplax specularis.</i>	<i>Typhlocarcinops marginata.</i>
<i>Psophteticus hughii.</i>	<i>Typhlocarcinops angustifrons.</i>
<i>Goneplax renoculis.</i>	<i>Typhlocarcinops ocularia.</i>
<i>Homoioplax</i> , new genus.	

The species enumerated form an important addition to the Goneplacidæ. The Philippine region appears to be a favorable locality for the genus *Carcinoplax*, as seven well-defined species are added to the four already known. The occurrence of the genus *Chasmocarcinus* is worthy of note, it having previously been taken only in American waters.

The new genus *Homoioplax* is founded on an old species.

Family GONEPLACIDÆ.

Subfamily CARCINOPLACINÆ.

CARCINOPLAX BISPINOSA, new species.

Type-locality.—North of Marinduque: Tayabas Light (outer), N. 53° W., 18.7 miles; lat. 13° 42' 50'' N.; long. 121° 51' 30'' E.; 90 fathoms; gy. m., s.; March 2, 1909; station 5376, *Albatross*; one male.

¹[Scientific results of the Philippine cruise of the Fisheries steamer "Albatross," 1907-1910.—No. 31.]
New species of crabs of the families Grapsidæ and Ocypodidæ. Proc. U. S. Nat. Mus., vol. 47, No. 2044, May 7, 1914, pp. 69-85.

Type.—Cat. No. 46163, U.S.N.M.

Dimensions.—Type male, length of carapace, 13.3 mm.; width of carapace, spines excluded, 15.3 mm.; width, spines included, 15.5 mm.; width between outer angles of orbits, 10.8 mm.; width of front, 5.3 mm.

Carapace very convex from front to back, less so from side to side; regions scarcely indicated; surface smooth and shining, covered with punctæ and minute granules; postero-lateral margins slightly convergent posteriorly, antero-lateral margins short, arcuate, and armed with two small sharp spines, the anterior of which is about one and one-half times its length from the orbit and points forward, and the posterior of which is twice as far from the anterior spine and is directed obliquely outward. In the single male specimen the spines of the left side are shorter than those of the right side and are bluntly rounded; they were doubtless broken off in some previous stage. The anterior edge of the front is nearly straight, and close behind and parallel to it there is a sulcus; sides of front obliquely longitudinal, with a depression above the antenna. The orbital margin has a finely granulated edge; the upper part slopes slightly backward and is a little sinuous.

The right cheliped is heavier than the other; a short, stout, acute, curved spine is on the upper margin, distal to the middle; the carpus is longer than wide and is armed with two spines, one at the inner angle and one at the outer angle, the former the larger; the manus is thick, its lower margin is arcuate, especially in the larger chela, where the height of the manus is nearly equal to its superior length; the fingers meet when flexed, their prehensile edges are irregularly toothed; the larger dactyl bears a large backward-pointing basal tooth in both sexes; tips of fingers crossing. In the large chela the terminal half of the fixed finger and the entire length of the dactylus below and two-thirds of its length above are a medium shade of horn-color; in the small chela the terminal half of both fingers is the same color.

The ambulatory legs are slender, the last three segments hairy, especially the dactyls, which are styliform, with the anterior or upper margin nearly straight.

The last five segments of the male abdomen form a triangle, slightly constricted between the fifth and sixth segments.

Differs from *C. indica*¹ in having two lateral spines instead of three, in the less advanced front, in the absence of a spine from the lower, outer margin of the arm, in the absence of a third, or dorsal spine, from the wrist, and in the shorter, stouter chelipeds.

¹ *Carcinoplax longimanus indicus* Doflein, Wiss. Erg. deutsch. Tiefsee-Exped. Valdivia, 1898-99, vol. 6, 1904, p. 114, pl. 35, figs. 1 and 2.

CARCINOPLAX SPINOSISSIMA, new species.

Type-locality.—Between Cebu and Bohol: Lauis Point Light, N. 10° E., 3.5 miles; lat. $10^{\circ} 10' \text{ N.}$; long. $123^{\circ} 53' 15'' \text{ E.}$; 165 fathoms; gy. m., s.; temp. 54.4° F. ; March 25, 1909; station 5417, *Albatross*; one male.

Type.—Cat. No. 46173, U.S.N.M.

Dimensions.—Type male, length of carapace, 28.3 mm.; width of carapace, spines excluded, 32.6 mm.; width, spines included, 33.5 mm.; width between outer angles of orbits, 19.2 mm.; width of front, 9.4 mm.

Carapace very convex from-front to back. Only the cardiac, intestinal, and posterior gastric regions are defined. Surface pubescent. Postero-lateral margins slightly convergent; antero-lateral margins shorter, armed with three sharp spines, of which the first is smaller than the second and third, which are subequal; the first spine may have an accessory spine on its posterior slope or two or three small spines or spinules outside its base; the second lateral spine has sometimes a very small spinule on its posterior slope. Edge of front beveled, faintly trilobed, granulate. Margin of orbit with sharp granules above, which become larger and spinelike at the outer angle and below; a short and small V-shaped sinus is situated at the middle of the upper margin.

Subhepatic and pterygostomian regions rough with sharp granules. Lower surface of crab pubescent, with longer hairs bordering the abdomen. Upper-outer surface of chelipeds long-hairy. Merus with a slender curved spine above, and several smaller uneven spines on the lower margins; surface near the margins rough with sharp granules. Exposed surfaces of carpus and manus also rough with sharp granules and small spines, the spines being situated near the inner angle of the wrist and in irregular longitudinal rows on the palm. The inner carpal spine is strong and acuminate and may bear spinules; near the outer angle there may be one, two, or three small spines. The spines of the palm include a very small one at the superior distal angle. Both fingers have two rough crests on the outer surface; the upper edge of the dactylus is rough with spinules. The brown color of the fingers extends on the outer margins from two-fifths to one-half the length from the tip; but on the prehensile edges from one-half to the whole length; prehensile edges irregularly toothed, meeting in the smaller cheliped, slightly separated in the larger cheliped; tips crossing; basal tooth of larger dactylus of moderate size.

Ambulatory legs fringed with long hair, merus joints with a small, slender, curved, subdistal spine; the third pair is nearly two and one-fourth times as long as the carapace, its merus is a trifle more than four times as long as wide; carpus and propodus of last pair considerably widened.

CARCINOPLAX CONFRAGOSA, new species.

Type-locality.—Between Cebu and Bohol: Cruz Point (Bohol), S. 20° E., 6 miles; lat. 9° 49' 35'' N.; long. 123° 45' E., 127 fathoms; temperature 59° F.; March 25, 1909; station 5420, *Albatross*; one female.

Type.—Cat. No. 46153, U.S.N.M.

Dimensions.—Type female, length of carapace, 38.7 mm.; width of carapace between tips of last lateral spines, 45 mm.; width between outer angles of orbits, 24.3 mm.; width of front, 11.7 mm.

Carapace very convex, inclining strongly downward anteriorly and postero-laterally; regions well defined, the hepatic region depressed; the granulation of the carapace is so coarse as to be visible to the naked eye, especially coarse on the branchial region; antero-lateral margin much shorter than the postero-lateral and armed with three well-developed teeth or spines, the first tooth distant from the orbit and the shortest, most dentiform and blunt-pointed, the second an acute-pointed tooth, the last a conical, sharp spine directed nearly forward; the three sinuses increase slightly in width from the anterior to the posterior; the carapace is just as wide a little behind the last teeth as it is between the tips of the last teeth.

The front, though nearly transverse, is bilobed, each lobe slightly concave and forming a small submedian tooth; a sulcus just behind the margin; a depression definitely separates the front from the orbits; the upper margin of the latter is transverse and furnished with bead granules; the granules of the lower margin are more pointed and more separated.

The chelipeds are distinctly unequal, short and stout; surface coarsely and unevenly granulate; a strong spine on the upper margin of the merus and the inner angle of the carpus and a smaller spine at the outer angle of the carpus. The greatest height of the larger palm is just equal to its superior length; a deep sulcus above the lower margin of the fixed fingers is continued back a little on the palm. Fingers elongate, gaping slightly when closed, teeth uneven, a large basal tooth on the larger dactyl; the brown color of the fingers occupies about half their length on the smaller chela, and runs up farther on the prehensile teeth; the brown is more extensive on the larger chela.

The legs are very hairy, especially on the margins of the last three segments. The third leg is twice as long as the carapace.

This species is not a typical *Carcinoplax*, as the carapace is not so smoothly rounded as in other species, and the front shows two submedian teeth.

CARCINOPLAX PURPUREA, new species.

Type-locality.—Near Marinduque Island: Tayabas Light (outer), N. 53° W., 18.7 miles; lat. 13° 42' 50'' N.; long. 121° 51' 30'' E.; 90

fathoms; gy. m., s.; Mar. 2, 1909; station 5376, *Albatross*; one female ovig. (type), one juv.

Type.—Cat. No. 46143, U.S.N.M.

Dimensions.—Type female, length of carapace, 29.5 mm.; width of carapace, 38.2 mm.; width between outer angles of orbits, 21 mm.; width of front, 9.7 mm.

Carapace very broad, with the antero-lateral margins very short and the postero-lateral margins almost parallel; surface very convex, both from front to back and from side to side, and covered with closely set granules which are much depressed and obscure on the posterior mesogastric and cardiac regions, elsewhere visible to the naked eye. The antero-lateral margin bears two projections, a tubercle distant from the orbit, and at a still greater interval a small forward-projecting spine. This spine is proportionally larger in small specimens. The postero-lateral margin has a small sinus some distance behind the spine. The anterior margin of the front is slightly concave, being most advanced at the outer angles, and also a little sinuous; the customary submarginal depression is hairy; sides of front very oblique, the sulcus between front and orbits being well marked. The upper margin of the orbit is concave, obscurely granulate, the lower margin has fewer, larger granules; the outer angle is pronounced but not dentiform.

The chelipeds (of the female) are rather elongate and unequal, coarsely granulate except on the fingers; the merus has a large tubercle on its upper margin; the carpus is considerably longer than wide, and bears a long, stout, blunt tooth or spine at its inner angle and a small, slender, sharp spine at its outer angle; the propodus is very thick, having a smooth, blunt, longitudinal ridge running through the middle of the inner surface. The larger palm is nearly one and one-half times as long, measured on the upper margin, as it is high, while the smaller palm is more than one and one-half times as long as high; a shallow longitudinal groove runs along the outer surface where it rounds into the upper surface. Fingers compressed, almost meeting when closed, armed with several large teeth interspersed with small ones, the larger dactylus bearing a large blunt, backward-pointing tooth at its base.

Legs very hairy, the last three joints clothed with long hairs which in the first three pairs form a furry coat but in the last pair are mostly marginal.

This species has much in common with *C. longimanus*, especially in the shape of wrist, chelæ, and carapace; the carapace, however, has more parallel sides behind the spines, the orbits are smaller and there is no tooth outside the orbit, as in *longimanus*. The arm has a tubercle in place of a spine; the wrist has a much smaller outer spine, although the inner spine is similar in the two species; and there is no prominent tubercle inside the palm.

CARCINOPLAX ANGUSTA, new species.

Type-locality.—Near Marinduque Island: Tayabas Light (outer), N. 53° W., 18.7 miles; lat. $13^{\circ} 42' 50''$ N.; long. $121^{\circ} 51' 30''$ E.; 90 fathoms; gy. m., s.; March 2, 1909; station 5376, *Albatross*; one female type, one male juv.

Type.—Cat. No. 46166, U.S.N.M.

Dimensions.—Type female, length, 23.8 mm.; width of carapace, 27.6 mm.; width between outer angles of orbit, 18.7 mm.; width of front, 9.8 mm.

A very narrow species. Carapace suboctagonal, the orbits being so oblique that they are almost in line with the adjacent antero-lateral margin, and the postero-lateral margins being not far from parallel. Carapace very convex, regions scarcely indicated, granulation fine and even, depressed, the granules trending forward. Margin of front faintly bilobed, each lobe slightly concave; corners broadly rounded; a notch above the antenna where the front joins the orbital margin. Upper margin of orbit nearly straight, the sulcus at its middle small but well marked; a small scallop at the outer angle; lobe at inner lower angle occupying half the lower margin of the orbit and very large and prominent. On the lateral margin of the carapace a small blunt tooth or large tubercle followed at a short distance by a very slight obtusangled tooth almost imperceptible; the distance from the orbit to the first tooth is greater than that between the two teeth. Behind the second tooth the margin is somewhat sinuous.

The margin of the epistome is cut into six scallops.

Chelipeds short and stout; merus with a short spine or tooth on upper margin; carpus large, with its inner angle swollen and tipped with a stout blunt spine. While the merus and carpus are granulated, the chelæ are smooth except for a low granulation on the upper surface. The larger palm, measured on its upper margin, is but little longer than its greatest height; a short, blunt tooth at end of upper margin; the fingers fit close together when shut, and cross considerably behind the tips; the brown color runs two-fifths the length of the dactylus, not so far on the fixed finger, but on both fingers the color extends further on the prehensile edge; above the lower margin of the immovable finger and extending back on the palm there is a deep groove. The length and height of the smaller palm are subequal, otherwise that chela is similar to the other.

Legs slender; the propodus of the last pair is considerably enlarged; this does not show on the right leg, which is abnormally reduced; last three segments moderately hairy.

In its narrow carapace this species resembles *C. bispinosa* but differs in its antero-lateral projections being bluntly dentiform instead of sharply spinose, in the orbits being oblique instead of trans-

verse, in the inner carpal spine being sharp instead of blunt, in the absence of an outer spine from the carpus, and the much narrower abdomen of the male.

CARCINOPLAX VERDENSIS, new species.

Type-locality.—Verde Island Passage: Sombrero Island, S. 80° E., 18.9 miles; lat. $13^{\circ} 45' 05''$ N.; long. $120^{\circ} 30' 30''$ E.; 394 fathoms; gn. m., s.; temperature 43.7° F.; January 21, 1908; station 5119, *Albatross*; one female ovig.

Type.—Cat. No. 46167, U.S.N.M.

Dimensions.—Female, length of carapace, 10.6 mm.; width of carapace, exclusive of spines, 12.7 mm.; width, inclusive of spines, 13 mm.

This species is narrower than *C. longipes*, the tooth next the orbit is much smaller and is a little less advanced than the outer end of the orbit, the next two antero-lateral projections are spines which are stouter and a little flattened, approaching the form of teeth; the postero-lateral margins are nearly straight and not very convergent; the denticle above the arm-joint is smaller and blunt; the spine at the inner angle of the wrist is larger, being strongly expanded on its proximal margin; the larger palm is higher and the prehensile teeth are lower; the fingers are very dark, nearly black; the legs are not quite so long and slender, and their carpus-propodus is a little more dilated.

CARCINOPLAX SPECULARIS, new species.

Type-locality.—Off southern Luzon: Sombrero Island, S. 7° W., 9.5 miles; lat. $13^{\circ} 51' 30''$ N.; long. $120^{\circ} 50' 30''$ E.; 159 fathoms; dk. gn. m.; January 17, 1908; station 5113, *Albatross*; one male.

Type.—Cat. No. 46164, U.S.N.M.

Dimensions.—Type male, length of carapace, 16.9 mm.; width of carapace, exclusive of teeth, 21 mm.; extreme width of carapace, 23 mm.; width between outer angles of orbits, 13.6 mm.; width of front, 6.7 mm.

This species has a strong resemblance to *C. longipes*.¹ The carapace is a little wider and appears wider than the measurements indicate on account of the broad antero-lateral teeth. The conspicuous pits of *longipes* are wanting. The first tooth is larger and more advanced than in *longipes*, with extremity rounded and lies close to, without embracing, the orbital margin; second and third teeth spiniform but not slender, the second one strongly curved, interspaces subequal. The edge of the front in front view is distinctly arcuate; in dorsal view faintly sinuous. The preorbital margin is nearly longitudinal. Eyes larger than in *longipes*.

¹ *Nectopanope longipes* Wood-Mason, Ann. Mag. Nat. Hist., ser. 6, vol. 7, 1891, p. 262.

The tooth on the upper margin of the merus of the cheliped is strong. The carpus is longer, measured from the articulation with the merus, than it is in the opposite direction, inner tooth excluded. This tooth is broad, thick, and blunt.

The chelæ are very unequal. On the upper surface of the manus there is an elongate-oval area which is nearly smooth and shining; viewed with a lens, it shows scattered granules, but presents an altogether different appearance from the rest of the manus, which is covered with crowded granules. The immovable finger is very wide at the middle. The color on the fingers is a light horn-color and covers about two-thirds of their length.

The ambulatory legs are not so long and slender as in *C. longipes*. Abdomen of male narrower than in that species.

PSOPHETICUS HUGHII, new species.

Type-locality.—Northern Mindanao: Macabalan Point Light, S. 31° to 39° E., 6 to 7.7 miles; lat. $8^{\circ} 35' 30''$ to $37' 15''$ N.; long. $124^{\circ} 36'$ E.; 200-220 fathoms; gn. m.; August 5, 1909; station 5504-5505, *Albatross*; one male.

Type.—Cat. No. 46180, U.S.N.M.

Dimensions.—Type male, length of carapace, 45.4 mm.; width without spines, 56.2 mm.; width with spines, 60 mm.; width between outer angles of orbit, 42.3 mm.

Carapace narrow, four-fifths as long as broad, with the sides strongly arched; surface very convex from front to back, conspicuously though irregularly punctate and pitted. The subtruncate front is slightly more advanced at the rounded angles than elsewhere; there is a very shallow sinus at the middle; the furrow above the edge is deep and narrow. Upper margin of orbit very oblique, but not so strongly sinuous as in *P. stridulans*; outer tooth broad, acute, directed obliquely outward. Spine at lateral angle of carapace acuminate and pointing strongly outward.

Chelipeds long and massive. Merus with a strong, much curved spine at middle of upper margin, three straight, slender spines on lower margin, two subdistal spinules on the inner margin. Carpus elongate, measured between the superior articulations with merus and manus; a stout, pointed spine at outer angle, inner angle produced, subacute. The fingers of the larger cheliped gape widely in their basal three-fifths, the distal two-fifths is strongly bent down.

The merus joints of the ambulatory legs are armed with a single, subdistal spine.

The first segment of the male abdomen covers the sternum on either side and is wider than the second or third segments.

P. hughii differs from the species previously described in its narrow and subcircular carapace; *P. stridulans*¹ is narrow but squarish,

¹ Wood-Mason, Illus. Zool. Investigator, Crust., part 1, 1892, pl. 5, fig. 1.

*P. insignis*¹ has rounded sides, but is very wide. It resembles *P. insignis* in its small exorbital tooth and the single spine on the legs; it resembles *P. stridulans* in the stout chelipeds, which are similarly armed, and in the general shape of palm and fingers. It differs from both those species in the base of the male abdomen, as the first and second segments do not cover the sternum in *stridulans* or *insignis*.

Named for Dr. Hugh M. Smith, now Commissioner of Fisheries, who was in charge of the work of the *Albatross* in the Philippines.

Subfamily GONEPLACINÆ.

GONEPLAX RENOCULIS, new species.

Type-locality.—Off southern Luzon: Malavatuan Island (N.), S. 23° E., 8.5 miles; lat. 14° 00' 00'' N.; long. 120° 17' 15'' E.; 80–102 fathoms; fne. s., m., sh.; temperature 59.6° F.; July 17, 1908; station 5278, *Albatross*; two females (one ovig., type; one with thin shell and broken).

Type.—Cat. No. 46307, U.S.N.M.

Dimensions.—Type female, length of carapace, 8.3 mm.; width of carapace, 12.6 mm.; width of front, 3.4 mm.; diameter of egg, about 0.3 mm. Male, length of carapace, 4.9 mm.; width of carapace, 7 mm.; width of front, 2.1 mm.

The sides of the carapace are less convergent posteriorly than in *G. rhomboides* (Linnæus), the spine at the outer angle of the orbit is long and slender, the spine behind it is dentiform, sharp, and of good size. The upper margin of the orbit is strongly sinuous, as it is directed suddenly backward before joining the outer spine; the orbit itself is much larger in its outer half to accommodate the large reniform eye, which lies in the same plane as the anterior part of the carapace; the eye-stalk is stout and channeled above the cornea; the cornea is chiefly ventral, anterior and posterior; the lower margin of the orbit has a tooth at about the middle of the stalk; the orbit has more of a tendency to divide into two fossæ than in typical *Goneplax*, on account of the great enlargement of the eye at the cornea.

The merus of the chelipeds not only has the strong spine near the middle of the upper margin which is present in *G. rhomboides*, but it has two slender spines on the distal half of the lower, outer margin. The carpus is more elongate, and its upper face more rectangular than in *rhomboides*, the inner spine being situated farther back.

The ambulatory legs are more slender and a little longer than in *rhomboides*, those of the third pair more than two and one-half times as long as the carapace. The merus joints have the customary sub-distal spines.

¹ Alcock, Journ. Asiatic Soc. Bengal, vol. 69, 1900, p. 310.

Subfamily PRIONOPLACINÆ.

HOMIOPLAX, new genus.

Differs from *Carcinoplax* Milne Edwards¹ only in having the third segment of the male abdomen too narrow at its base to cover the sternum between the last pair of legs, a character which distinguishes the subfamily Prionoplacinæ from the Carcinoplacinæ. The first segment and the proximal portion of the second segment of the abdomen in *Homoioplax* do cover the sternum, as in *C. longimanus*.

Type of genus.—*Homoioplax haswelli* (Miers) = *Pseudorhombila haswelli* Miers, Crust. Alert, 1884, p. 241.

(ὁμοιος, similar; πλαξ, anything flat and broad, carapace.)

Subfamily RHIZOPINÆ.

CERATOPLAX FULGIDA, new species.

Type-locality.—Near Marinduque Island: Tayabas Light (outer), N. 43° W., 6 miles; lat. 13° 49' 40'' N.; long. 121° 40' 15'' E.; 83 fathoms; gn. m.; February 24, 1909; station 5371, *Albatross*; one male type, one female.

Type.—Cat. No. 46401, U.S.N.M.

Dimensions.—Type male, length of carapace, 4.5 mm.; width of same, 7.4 mm.; fronto-orbital distance, 4.1 mm.; front, 2.2 mm.; length of third leg, 10.3 mm.

Smooth, shining, and bare except for a few hairs on the terminal half of the legs, a border on the inner edge of the merus and carpus of the chelipeds, and pubescence on lower surface of carapace. The carapace is anteriorly deflexed, antero-lateral margins acute, postero-lateral margins blunt and converging behind, posterior margin arcuate. Regions scarcely indicated, although there are some pit-like depressions regularly placed. Front faintly bilobed, corners rounded, edge sharp. The pear-shaped eyes have their upper surface separated from their anterior surface by an acute edge continuous with the margin of the carapace; cornea black, ventro-terminal.

Epistome vertical, edge sharp and straight, not emarginate. Buccal cavity broadly quadrate, filled by the maxillipeds; outer angle of the merus strongly produced in a truncate tooth.

Chelipeds nearly equal, dissimilar; wrist without an inner tooth; propodus with a sharp, marginal line below; propodal finger a little deflexed; fingers when closed, nearly meeting, tips crossing; middle teeth of larger immovable finger prominent; teeth of smaller chela lower and more acute.

Dactyli of first three legs falciform; of last leg, bowed downward and backward.

First segment of male abdomen linear, almost imperceptible; second half as long as the third and broadest distally; lateral angles of

¹ Ann. Sci. Nat., ser. 3, vol. 18, 1852, p. 164 [128].

third segment acute; third to seventh segments subtriangular with concave sides; terminal segment suboblong with tip rounded.

This species and the following one are so much wider than *C. ciliata* Stimpson¹ and *C. hispida* Alcock² that they are in no danger of being confused.

CERATOPLAX TRUNCATIFRONS, new species.

Type-locality.—Off western Samar: Badian Island (N.), N. 27° E., 5.75 miles; lat. 11° 31' 40'' N.; long. 124° 42' 40'' E.; 32 fathoms; gn. m.; April 14, 1908; station 5206, *Albatross*; one male.

Type.—Cat. No. 46399, U.S.N.M.

Dimensions.—Type male, length of carapace, 4.4 mm.; width of same, 7.4 mm.; fronto-orbital distance, 3.7 mm.; front, 1.8 mm.

This species is so closely allied to the preceding, *C. fulgida*, that it can best be described by comparison. The greatest width of the carapace is further back, the antero-lateral margins being longer and the postero-lateral shorter; the latter converge very little, almost imperceptibly. The front is truncate; the eyes viewed from before are higher; the ischiognath is wider; fingers longer; those of the smaller chela more deflexed and with smaller teeth, the immovable finger of the larger chela with less prominent teeth; base of abdomen narrower, first segment longer, being plainly visible, third segment much less extended laterally, its angles nearly right angles, terminal segment shorter, its length and breadth equal.

TYPHLOCARCINUS CRATERIFER, new species.

Type-locality.—East of Masbate Island: Destacado Island (S.), N. 87° E., 8.5 miles; lat. 12° 15' N.; long. 123° 57' 30'' E.; 80 fathoms; s., m., sh.; April 20, 1908; station 5213, *Albatross*; one female.

Type.—Cat. No. 46397, U.S.N.M.

Dimensions.—Type female, length of carapace, 9.9 mm.; width of same, 13.5 mm.; fronto-orbital distance, 5.7 mm.; width of front, 2.8 mm.

Surface covered with pubescence; margins fringed. The anterior part of the carapace is strongly bent down, the postero-lateral margins are subparallel and form a small, obtuse tooth at their union with the antero-lateral margins; posterior margin arcuate. The grooves separating the branchial from the gastric and cardiac regions are deep; mesogastric region well-defined; from it a median furrow leads to the edge of the front; when the pubescence is removed, the carapace appears coarsely punctate; near the lateral margins it is finely granulate; near the end of the cervical suture and almost in line with the orbital tooth there is a small but conspicuous crater-like pit; behind

¹ Alcock, Journ. Asiatic Soc. Bengal, vol. 69, 1900, p. 320, and synonymy.

² Journ. Asiatic Soc. Bengal, vol. 69, 1900, p. 321.

and outside this there is a much smaller and shallower pit. Edge of front bilobed. Upper surface of eye flat, smooth, hemispherical; cornea black, terminal.

Sides of buccal cavity parallel; anterior edge arcuate. Maxillipeds filling the cavity, merus with antero-external angle slightly produced. Pterygostomian regions protuberant.

Chelipeds equal in the female; they are granulous toward the margins and smooth in the middle; lower margin of propodus acute, not deflexed; fingers meeting when closed, except for a very small gape at base; teeth of the immovable finger larger than those of the dactylus, the highest tooth being the third from the base.

The only legs preserved are those of the last pair and a single unattached one; they are smooth and fringed with long hair.

This species is larger than *T. nudus* Stimpson,¹ *villosus* Stimpson¹ and *rubidus* Alcock;² the first two have two or more lateral teeth instead of one, while *T. rubidus* has none.

HEPHTHOPELTA APTA, new species.

Type-locality.—Between Cebu and Bohol: Lauis Point Light, N. 27° E., 17.8 miles; lat. 9° 58' 30'' N.; long. 123° 46' E.; 175 fathoms; gn. m.; temperature 54.5° F.; March 25, 1909; station 5419, *Albatross*; one male.

Type.—Cat. No. 46389, U.S.N.M.

Dimensions.—Type male, length of carapace, 8 mm.; width, 9.7 mm.; width across front and orbits, 4.5 mm.; length of third leg, 17.2 mm.

Carapace granulous and pubescent, with somewhat longer hairs on the lateral margins, edge of front not visible in dorsal view. Eye-stalks moderately constricted next the cornea; although the smooth corneal surface is large, the pigment spot is small and dull-colored. The basal joint of the antennules fills the fossette but is not bulging. The maxillipeds gape considerably, and when in place the palpus does not cover the orifice of the efferent branchial canal; the merus has its rounded outer angle produced a little.

The chelipeds are rather massive and very unequal; margins of merus granulous, a few granuliform denticles projecting from the lower margin; a tooth at inner angle of carpus. Larger chela smooth except on the margins; palm high and thick; fingers meeting in their distal third; the immovable finger is bent down at its extremity, its upper edge along the gape is bent strongly outward and forms a tooth distal to the middle; near the base of the concave prehensile surface there is a tubercle; dactylus arched, having a large tooth near its middle. Smaller chela thick, lower surface

¹ Alcock, Journ. Asiatic Soc. Bengal, vol. 69, 1900, p. 322, and synonymy.

² Journ. Asiatic Soc. Bengal, vol. 69, 1900, p. 323.

flattened, oblong, with pronounced inner and outer margins, and not reaching as far as the finger, the inner margin ending distally in a prominent angle rounded off, the outer margin ending in a stout, blunt, outward-pointing spine; inner surface of palm rising in an obliquely-longitudinal crest through the middle; the inner margin of the upper surface ends proximally in a tubercle; surface finely granulous; upper surface also rugose; lower margins and inner crest tuberculous; fingers meeting throughout, finely toothed, outer margins fringed with hair. When the smaller cheliped is flexed there is formed on the lower side a small hole bounded by the ischium, merus, and propodus; it is probable that this hole serves as a passage for water into the left afferent branchial canal. The gape between the fingers of the larger cheliped forms, when that member is flexed, an oval area fringed with hair, widening toward the body by the peculiar slope of the immovable finger, and situated directly over the orifice of the right branchial canal.

The narrow legs are pubescent and the last three joints fringed with hair.

Between the fourth and fifth segments of the sternum a narrow plate is intercalated; this character is generic. In this species the plate covers the genital canal leading from the coxa. The abdomen is small, first segment almost concealed under carapace, third to fifth segments partially fused, third to seventh segments subtriangular, seventh segment oblong.

This species differs from *H. lugubris*¹ in its constricted eyestalks, in the produced outer angle of the merognath, in the arching dactylus and deflexed immovable finger of the large cheliped, and the flat lower surface of the small cheliped.

CHASMOCARCINUS CAVIMANUS, new species.

Type-locality.—Tanon Strait, east coast of Negros: Pescador Island, N. 72° E., 3.3 miles; lat. 9° 56' 30'' N.; long. 123° 15' E.; 300 fathoms; gn. m.; temperature 62.8° F.; April 1, 1908; station 5189, *Albatross*; one male.

Type.—Cat. No. 46413, U.S.N.M.

Dimensions.—Type male, length of carapace, 11.6 mm.; width of same, 14.4 mm.; fronto-orbital width, 7 mm.; front, 3.3 mm.

The carapace is loosely covered by a short, thin pubescence the removal of which discloses coarse punctæ and fine granules; the latter are especially abundant on the median regions and near the margins. The longitudinal depressions at the inner angles of the branchial regions are very deep. The carapace is widest a little in front of the postero-lateral angles; middle third of posterior margin transverse; upper margin of orbit transverse; front with sides slightly convergent

¹ Alcock, Journ. Asiatic Soc. Bengal, vol. 69, 1900, p. 327, and synonymy.

anteriorly, edge bilobed with a shallow emargination, outer angles rounded.

The eyes are of fair size; the stalk tapers a little distally; cornea well-developed, covering the whole end of the stalk. The basal segment of the antennules is ventrally flattened; second segment very long, as long as the orbit is wide; third segment five-sixths as long as second; flagellum about one-third as long as the preceding segment, each of its segments fringed with long hair, longer than the whole flagellum. The epistome is much deeper in the middle than elsewhere, curving backward between the palps of the maxillipeds; the edge is thin and vertical. Sides of buccal cavity parallel. Maxillipeds widely gaping, the gape wider than either endognath; outer margin of merus convex.

Chelipeds very unequal; the merus is sparingly furnished with fine granules, the lower edge bears a few spines; the carpus has a strong inner spine, and its upper surface is inwardly granulate; the palm has rounding margins and is granulate above; fingers of the large chela irregularly toothed; on the dactylus there is a large tooth near the base, then a small one followed by a sinus and a medium-sized tooth; opposite this cluster of teeth the immovable finger is armed with an irregular molariform tooth which is directed outward; near the tip are two teeth diminishing distally; the fingers gape moderately except at the terminal third; lower edge of fixed finger convex. The palm of the smaller chela of the male has on the inner surface reaching from the middle to the lower edge a large blunt compressed tooth; proximal to this tooth the surface is deeply hollowed out, the cavity embracing also a part of the outer surface. When the cheliped is flexed, the tooth fits in a sinus on the inner margin of the arm between two tubercles. The fingers fit close together; those of the dactylus are all shallow except one near the base; those of the fixed finger are narrower and more acute and about four of them at intervals are enlarged.

Legs slender, pubescent, and hairy, first three dactyli styliiform, fourth recurved.

Abdomen and sternum granulate; abdomen small; first segment very short especially across the middle; second widening distally; third, fourth, and fifth fused; outer angles of third blunt; sixth with a low, broad, terminal tubercle; terminal segment suboblong. A broad plate is intercalated between the fourth and fifth segments of the sternum.

This species is nearest to *C. typicus*¹, in which the carapace is narrower, the chelæ flattened, the fingers of the larger chela strongly deflexed and evenly toothed.

¹ Rathbun, Bull. Labor. Nat. Hist. State Univ. Iowa, vol. 4, 1898, p. 285, pl. 7, figs. 3-5.

Subfamily TYPHLOCARCINOPSINÆ.

TYPHLOCARCINOPS DECRESCENS, new species.

Type-locality.—Tawi Tawi Group, Sulu Archipelago: Tinakta Island (E.), N. 12° W., 1.8 miles; lat. $5^{\circ} 10' 15''$ N.; long. $119^{\circ} 53'$ E.; 16 fathoms; fne. s., blk. sp.; February 22, 1908; station 5161, *Albatross*; four males, two females (one male is type).

Type.—Cat. No. 46407, U.S.N.M.

Dimensions.—Type male; length of carapace, 8.2 mm.; width of same, 10.1 mm.; width across front and orbits, 4.6 mm.; width of front, 2.3 mm.; length of third leg, 17.5 mm.

The surface is almost entirely pubescent except the outer side of the larger palm of the male, and the margins are fringed with hair. Carapace strongly bent downward anteriorly, nearly level from side to side, widest near the middle, postero-lateral margins sinuous, but with a general longitudinal direction, posterior margin convex. Beginning a little behind the orbit the margin is acute and soon forms a narrow crest which terminates at the middle of the postero-lateral margin; three shallow notches form as many slight teeth or lobes; surface near the margin sparingly granulate; these features are not visible until the hair is removed. Cardiac and posterior mesogastric region well-defined. The eyes fill the oval orbits but do not project beyond the general curve of the carapace; the cornea is pale and terminal. The front is widest just above the antennæ and is constricted behind that point, its anterior edge is arcuate and bilobed; a dorsal median furrow.

The epistome is short and its posterior edge is strongly arched forward either side of the middle. Sides of buccal cavity parallel; when the maxillipeds are in place they do not touch each other; merognath subquadrate, its antero-external angle obtuse but well-defined.

Chelipeds very unequal in the male; merus unarmed; carpus angled but not dentate on the inner side, sparingly granulate along the inner distal margin; propodus high, smooth, lower margin subacute, set off on the immovable finger by a deep groove; prehensile edges of fingers furnished with low teeth or lobes; the fingers gape narrowly and cross at the tips; in alcohol they are light horn-color. In the female the chelipeds are nearly equal, both are covered with pubescence, and the fingers nearly meet.

Although the length of the legs is represented by 3.2.1.4, the third being the longest and the fourth the shortest, yet their dactyli diminish notably in length from the first to the fourth pair, a fact to which the specific name draws attention.

The second and third segments of the abdomen have their lateral margins angled; the fourth to seventh segments taken together are

oblong with the sides moderately convergent; all the segments are distinct.

This species differs from *T. canaliculata* Rathbun¹ and *T. piroculata* Rathbun² in its narrower fronto-orbital region, less than half as wide as the carapace, instead of more than half, as in those species; in the dactyli diminishing in length from the first to the fourth pair; in the indented lateral margins of the carapace.

TYPHLOCARCINOPS MARGINATA, new species.

Type-locality.—Off eastern Palawan: 30th of June Island, N. 29° E., 12.2 miles; lat. 9° 12' N.; long. 118° 28' E.; 27 fathoms; fne. gy. s.; April 3, 1909; station 5426, *Albatross*; one male.

Type.—Cat. No. 46395, U.S.N.M.

Dimensions.—Type male, length of carapace, 6.7 mm.; width of same, 8.7 mm.; width across front and orbits, 4.5 mm.; width of front, 2.3 mm.; length of third leg, about 14.2 mm. (The tip of the dactyl is broken off.)

Surface pubescent, margins scantily fringed with hair. Carapace nearly level from side to side, bent down anteriorly so as to conceal the edge of the front in dorsal view; H-depression deep, mesogastric region wholly delineated, protogastric partially so; posterior half of carapace granulate, granules elsewhere obscure and scattered; postero-lateral margins straight and posteriorly convergent; antero-lateral margins long, denticulate, three interruptions in the denticles forming three teeth; the anterior tooth is truncate, on the other teeth the anterior denticle is acute making a dentiform tooth; in the smaller specimen the teeth are considerably narrower and are tuberculiform and subtruncate. Edge of front bilobed, lobes nearly transverse. Orbits pyriform, eyes somewhat protuberant, corneæ dark, ventral-terminal.

Epistome well developed and with a sharp edge; buccal cavity quadrate (as to sides and front, in ventral view) with corners rounded, completely filled by the broad maxillipeds; the outer edge of the merognath slants outward to the anterior angle.

Chelipeds not very unequal; merus and carpus granulate toward the margins; palm unevenly granulate, most so near the lower margin; fingers grooved, prehensile edges furnished with triangular teeth; a very small gape at base when fingers of larger chela are closed.

Legs slender; dactyli of first three pairs subequal, of last pair much shorter and strongly upcurved.

Abdomen with first segment linear; second, half as long as the third, both laterally acute, the third widest at its proximal end;

¹ Proc. Biol. Soc. Washington, vol. 22, 1909, p. 112.

² Trans. Linn. Soc. London, ser. 2, Zool., vol. 14, 1911, p. 239.

fourth to sixth, inclusive, moderately convergent; the seven segments distinct.

The fronto-orbital distance of *T. marginata* though greater than in *decrescens* is less than in *canaliculata* and *piroculata*, being little more than half the width of the carapace; this species is the only one of the genus in which the postero-lateral margins converge toward the posterior margin, and it is also peculiar in having three antero-lateral teeth.

TYPHLOCARCINOPS ANGUSTIFRONS, new species.

Type-locality.—Between Marinduque and Luzon: San Andreas Island (W.), S. 57° W., 8.5 miles; lat. $13^{\circ} 38'$ N.; long. $121^{\circ} 58'$ E.; 50 fathoms; sft. gn. m.; April 24, 1908; station 5220, *Albatross*; one male.

Type.—Cat. No. 46409, U.S.N.M.

Dimensions.—Type male, length of carapace, 11.7 mm.; width of same, 15.1 mm.; fronto-orbital width, 6.6 mm.; front, 3.5 mm.

Very close to *T. marginata*, but differs as follows: Size much greater; fronto-orbital distance shorter; postero-lateral margins more convergent; only two antero-lateral teeth, the first one in *marginata* being represented by a slight depression in the margin, without any break in the row of granules; the pigment spot on the eye is so faint as to be almost indistinguishable; the merognath is not produced at the outer angle.

TYPHLOCARCINOPS OCULARIA, new species.

Type-locality.—Between Samar and Masbate: Tubig Point, Destacado Island, N. 49° E., 5 miles; lat. $12^{\circ} 12' 35''$ N.; long. $124^{\circ} 02' 48''$ E.; 135 fathoms; gn. m., s.; March 13, 1909; station 5392, *Albatross*; one male.

Type.—Cat. No. 46408, U.S.N.M.

Dimension.—Type male, length of carapace, 14 mm.; width of same, 17.2 mm.; fronto-orbital width, 6.6 mm.; front, 3.6 mm.; length of third leg, 31 mm.

Covered with a short, close pubescence mixed with scanty soft hairs, except the chelipeds which are bare and shining save on the margins; postero-lateral margins posteriorly slightly convergent; lateral margins entire; median regions and cervical suture defined; margins finely granulate; front arcuate, bilobed. Orbits suborbicular, eyes flat, corneæ well-developed. Epistome narrow, deep, edge sharp. Sides of buccal cavity parallel, anterior margin arcuate; maxillipeds separated by a narrow gape; outer angle of merognath rounded.

Chelipeds massive, very unequal; margins of merus and carpus fringed with hair; lower edge of propodus marginate; fingers of large chela deflexed, gape narrow, tips much curved, crossing; on each

finger a sharp tooth at the middle, and a molar process at the base which is divided into two or three teeth; the smaller chela has the lower margin coarsely granulous and hairy, fingers less deflexed, almost meeting, teeth of propodus larger than those of dactylus, with three of them enlarged.

First three legs similar, fourth much shorter, with upcurved dactyl.

First segment of abdomen linear; second short, with pointed ends; third with outer angles rounded, surface convex except at the middle; remainder of abdomen suboblong.

The narrow front, round orbits and large chela with its few prehensile teeth easily distinguish this species.

DESCRIPTIONS OF NEW GENERA AND SPECIES, WITH NOTES ON PARASITIC HYMENOPTERA

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In this paper will be found descriptions of three species of Ichneumonoidea, and two genera and ten species of Chalcidoidea believed to be new to science. Some synonymical and other notes on described species are also included.

Superfamily ICHNEUMONOIDEA.

Family ICHNEUMONIDAE.

Subfamily OPHIONINAE.

Genus CASINARIA Holmgren.

Amorphota orgyiae Howard, type of the genus *Amorphota*, agrees with the characterization of *Casinaria* given by Szepligeti. Specimens of the genotype species of *Casinaria* are not available for comparison, but descriptions of that species, *Casinaria tenuiventris* Gravenhorst, leave no doubt that *Amorphota* is a synonym of *Casinaria*.

CASINARIA INFESTA Cresson.

Limneria infesta CRESSON, Trans. Amer. Ent. Soc., vol. 4, 1872, p. 172.

Limnerium sessilis ASHMEAD, Proc. U. S. Nat. Mus., vol. 12, 1890, p. 433.

Limnerium erythrogaster ASHMEAD, Proc. U. S. Nat. Mus., vol. 13, 1890, p. 434.

Limnerium ashmeadi DALLE TORRE, Cat. Hym., vol. 3, 1901, p. 90.

Anempheres diaphaniae VIERECK, Proc. U. S. Nat. Mus., vol. 40, 1912, p. 188.

After comparison of the types, the writer is convinced that all of the above names represent the same species.

SAGARITIS DUBITATUS Cresson.

Mesoleptus dubitatus CRESSON, Proc. Ent. Soc. Phila., vol. 3, 1864, p. 259.

Limnerium provancheri DALLE TORRE, Cat. Hym., vol. 3, 1901, p. 102.

Limnerium (Campoletis) prodeniae VIERECK, Proc. U. S. Nat. Mus., vol. 40, p. 190.

Cresson's species undoubtedly belongs in *Sagaritis*, so that Dalle Torre's name is unnecessary. Viereck's types are in every way typical specimens of *dubitatus*.

Genus HYPOSOTER Foerster.

It is the opinion of the writer that the genotypes of the following genera as established by H. L. Viereck¹ are all congeneric:

Hyposoter Foerster, *Hypothereutes* Foerster, *Ischnoscopus* Foerster, *Ameloctonus* Foerster, and *Anilastus* Foerster. *Hyposoter*, being the oldest name by page preference, becomes the name to be used.

HYPOSOTER INTERJECTUS, new species.

Female.—Length approximately 5.5 mm. Black with close white pubescence on the head, thorax, and abdomen; scape and pedicel reddish-yellow; flagellum black; palpi, mandibles except their apices, tegulae, front coxae and all trochanters, except the first joint of the posterior pair, pale yellow or whitish; median coxae, fore and median femorae and tibiae and the hind femorae reddish-yellow; hind coxae black, the hind tibiae blackish at base and apex with the middle paler; front and middle tarsi yellowish, their apices brown; hind tarsi very dark brown or blackish, the base of first joint pale; abdomen with the first segment, basal two-thirds and a narrow apical band of second black; following segments more or less blackish on the median dorsal portion; sides and venter reddish-yellow.

Head and thorax closely punctate and opaque; antennae 36-jointed in the type; anterior margin of the clypeus slightly rounded; eyes distinctly but not deeply emarginate just above the antennae; ocelli distant from the eye-margin a little more than the greatest diameter of an ocellus, postocellar line not twice the lateral ocellar line; propodeum in the type with a rather poorly defined areola which is longer than wide and open behind; areolet of the front wings with a short petiole, the recurrent nervure joining cubitus behind the middle of the areolet; first abscissa of radius nearly half as long as the second; subdiscoidal vein arising from the middle of the second discoidal cell; nervellus of the hind wing slightly curved but not at all angularly broken; first joint of the hind tarsi more than twice as long as the second; last joint of the tarsi, not including the claw, about equal to the fourth joint, claw distinctly pectinate; longer of the hind tibial spurs very nearly two-thirds the length of the first tarsal joint; abdomen dilated below from the third segment, not strongly compressed, the ovipositor scarcely exerted beyond the apex of the abdomen; spiracles of the second segment at the middle; petiole with a distinct fossa laterally before the spiracle.

Male.—Unknown.

Type-locality.—Arcola, Mississippi.

Host.—*Prodenia ornithogalli*.

Type.—Cat. No. 18327, U.S.N.M.

¹ Bulletin 83, U. S. National Museum, 1914.

One specimen from the type-locality reared by W. R. McConnell, June 1, 1913, and recorded in the Bureau of Entomology, United States Department of Agriculture, under Webster No. 9627. A paratype female from Lakeland, Florida, G. G. Ainslie, collector, and recorded under Webster No. 9402C, was reared from a larva on corn.

The paratype has the median areola of the propodeum more poorly defined than in the type, the parallel carinae behind the costulae being almost wholly obsolete.

The present chaotic condition of the North American Campopleginae as regards both genera and species make it practically impossible to determine species of this group. A thorough revision may show the foregoing as well as the following species to be already described.

NEPIERA BENEVOLA, new species.

Female.—Length, 4.5 mm. Head and thorax very finely closely punctate and covered with short white pile; antennae slender, 27-jointed in the type, the first flagellar joint fully four times as long as broad, following joints gradually decreasing in length; inner eye-margins straight or very nearly so; clypeus indistinctly separated from the face by a slight depression, the lateral grooves not deep; ocellular line about one and one-half times the diameter of an ocellus and shorter than the postocellar line; mesopleurae with a smooth area beneath the posterior wing, otherwise sculptured like the mesoscutum; propodeum sculptured like the mesoscutum, scarcely projecting over the base of the hind coxae, not or very slightly hollowed out behind and distinctly areolated, the areola confluent with the petiolar area and appearing nearly twice as long as broad, the median basal area nearly parallel-sided and longer than broad, propodeal spiracles touching the marginal carina of the propodeum; areolet of the front wings sessile and receiving the recurrent nervure slightly before the middle; nervulus oblique; subdiscoidal nervure joining the second discoidal cell at the middle; nervellus of the hind wing curved but not angularly broken; longer of the hind tibial spurs a little less than half the length of the first tarsal joint; abdomen pilose, longer than the head and thorax, only slightly compressed; spiracles of the first tergite a little farther from the apex of the segment than from each other, postpetiole nearly parallel-sided, second tergite distinctly longer than the third and not compressed, its spiracles slightly behind the middle; following segments successively shorter; ovipositor exerted about one-fifth the length of the abdomen. Head and thorax black; antennae entirely black; mandibles, except at apex, tegulae, and trochanters, except the basal joint of the posterior pair, yellow; palpi almost white; anterior and median coxae and femorae and the anterior tibiae pale ferruginous, median tibiae brownish, posterior coxae and first joint of trochanters black, posterior

femorae dark ferruginous and tinged with blackish at base and apex, their tibiae dark brown or blackish with an obscure yellowish stripe on each side medially, anterior and median tarsi brownish, the posterior pair black; wings hyaline, the veins and stigma usually blackish; abdomen black, the dorsal tergites beyond the first each with a complete apical yellowish-ferruginous band which broadens out laterally on the segments beyond the second; ovipositor sheaths black.

Male.—Essentially the same as the female.

Type-locality.—Salt Lake, Utah.

Host.—*Eurymus eurytheme*.

Type.—Cat. No. 18328, U.S.N.M.

Five females and eight males from the type-locality, L. P. Lockwood, collector, and recorded in the Bureau of Entomology under Webster No. 6664.

Family ALYSIIDAE.

Subfamily ALYSIINAE.

APHAERETA SARCOPHAGAE, new species.

Female.—Length, about 2 mm. Black, polished; the antennal scape, pedicel, palpi, mandibles, legs including all coxae, and the first abdominal segment testaceous; wing veins and stigma dark brown, the second cubital cross vein pale. Antennae 23-jointed in the type; first flagellar joint not longer than the scape and pedicel combined, about two-thirds the length of the second flagellar joint, slightly shorter than the third, about equal to the fourth, and a trifle longer than the fifth; head about twice as wide as long antero-posteriorly, occiput concave and polished; frons and vertex polished, the latter without a median groove or with only a trace of one between the ocelli; face smooth with a few indistinct scattered punctures, more distinct on the clypeus; mandibles tridentate, the median tooth acute, the two lateral obtuse and not produced. Mesoscutum smooth and polished, without furrows; mesopleurae with a foveolate furrow below which does not extend to the posterior margin; propodeum mostly smooth, with a sharp median carina which splits about midway of the propodeum, the two branches inclosing a narrow wedge-shaped petiolar area, transverse carina present, the posterior face of the propodeum more or less wrinkled. Wings subhyaline, the stigma rather broader than usual for the genus; first abscissa of radius about equal to the width of stigma and half as long as the first transverse cubitus; second abscissa of radius nearly twice the length of the first transverse cubitus, second transverse cubitus one-half the length of the first; second discoidal cell effaced below. Abdomen about as long as the thorax; first segment bicarinate at base, convex and rugulose medially on the apical half, the lateral margins nearly smooth; segments

beyond the first smooth and polished; ovipositor exerted nearly the length of the abdomen.

Male.—Essentially like the female; antennae 22-jointed in the type; abdomen spatulate.

Type-locality.—Wellington, Kansas.

Host.—*Sarcophaga, kellyi*.

Type.—Cat. No. 18329, U.S.N.M.

Five females and five males from the type locality reared by E. O. G. Kelly and recorded under Webster No. 7398, Bureau of Entomology, United States Department of Agriculture.

In C. T. Brues's key to the species of this genus¹ this runs to section 7, but is apparently separable from all three species in that category by the areolation of the propodeum and the different length of the second flagellar joint.

Superfamily CHALCIDOIDEA.

Family CALLIMOMIDAE.

Subfamily MONODONTOMERINAE.

LIODONTOMERUS, new genus.

Antennae 13-jointed, with two ring-joints; funicle 6-jointed; face rather long and very slightly narrowed above; occipital foraminal depression immargined; pronotum shorter than the mesonotum; propodeum without carinae and also without spiracular sulci; marginal vein shorter than the submarginal, the stigmal shorter than the postmarginal; front femorae not or only slightly swollen, posterior femorae with very slight indications of teeth on the lower apical margin or without any teeth; first dorsal abdominal segment incised medially.

Type of the genus.—*Liodontomerus perplexus*, new species.

Plesiostigmodes, Ashmead *Dimeromicrus*, and *Idiomacromerus*, Crawford have two ring-joints in the antennae. This new genus can be separated from the first by the short pronotum and the unswollen front femora, while from the others it differs in the immargined occiput.

LIODONTOMERUS PERPLEXUS, new species.

Female.—Length, 1.6 to 1.8 mm. Antennae clavate; funicle joints all broader than long and broadening slightly toward the club; club broader than the funicle and about equal in length to the three last funicle joints combined. Head and thorax closely punctate; the propodeum less strongly sculptured than the rest of the thorax, only faintly lineolated medially, the sculpture more evident laterally;

¹ Twelfth Rept. State Entomologist of Minnesota, 1907, p. 212.

marginal vein slightly less than half the length of the submarginal and not quite twice the length of the postmarginal; abdomen lineolated, not longer than the head and thorax; ovipositor about two-thirds the length of the abdomen. Head and thorax brassy-green, the abdomen entirely bronze above, its sides slightly darker; antennae black, slightly tinged with bronze; all coxae, trochanters, and femorae bronzy; median and hind tibiae usually dark brown except at base and apex; front tibiae, base and apex of hind and median tibiae, and all tarsi yellowish; the apical tarsal joint brown.

Male.—Similar to the female except that the head and thorax are brighter blue-green and the femorae less tinged with bronze; the third flagellar joint (first funicle joint) is often so reduced as to give the appearance of three ring-joints. The same is true to a less extent with the female.

Type-locality.—Yuma, Arizona.

Type.—Cat. No. 18330, U.S.N.M.

Described from 40 specimens from the type-locality reared by T. D. Urbahns from alfalfa seed pods infested with *Brucophagus funebris*, and recorded in the Bureau of Entomology under Webster No. 7202.

Family ENCARTIDAE.

Subfamily EUPELMINAE.

ANASTATUS SEMIFLAVIDUS, new species.

Female.—Length, 2.3 to 2.5 mm. Head strongly punctate; eyes elliptical; antennal pedicel about two-thirds the length of the first funicle joint; ring-joint transverse; first, second, and third funicle joints subequal, following joints shorter; mesoscutum with the median and lateral lobes alike faintly scaly-punctate and hairy; the median lobes more distinctly sculptured bordering the lateral margins; scutellum and axillae very finely and closely punctured, the former precipitous posteriorly and the posterior face smooth; propodeum smooth; mesopleurae mostly smooth, but with the anterior portion above scaly-punctate; postmarginal vein twice as long as the stigmal, the marginal a little more than twice the postmarginal; abdomen faintly lineolate, about as long as the thorax. Scape reddish-yellow, flagellum black; head brassy-green; mesoscutum, punctate area on the mesopleurae, posterior face of the scutellum, propodeum, hind coxae, and underside of the thorax metallic blue-green; scutellum and axillae varying from wholly pale orange-yellow to dark brown, with only the bases yellowish; remainder of the thorax reddish yellow; legs yellowish within and along the margins, blackish or brownish outwardly, the femora often tinged with metallic; wings fuscous, the base hyaline to the beginning of the marginal vein and a broad hyaline transverse band before the stigmal vein; abdomen yellowish

above except the three apical segments, which are darker and somewhat metallic; venter pale at base, brownish medially and metallic apically.

Male.—Head strongly punctate; antennal scape compressed and expanded beneath, pedicel very short, flagellum tapering slightly from base to apex; first funicle joint about twice as long as wide; following joints successively shortening; club scarcely as long as the two last funicle joints combined; mesoscutum and scutellum alike scaly-punctate, mesopleurae mostly smooth; propodeum smooth; postmarginal vein nearly as long as the marginal and a little more than twice the length of the stigmal; abdomen reticulately lineolate. Color dark blue-green; antennae black, the expansion of scape pale; abdomen beyond the first segment brownish-black; all trochanters, a line above and the apices of front and middle femorae, front tibiae outwardly for its whole length, basal third of middle and hind tibiae and the three basal joints of the middle and hind tarsi yellowish-white; front tarsi and apical two joints of the other tarsi fuscous; remainder of the legs blue-green or blackish.

Type-locality.—Koehler, New Mexico.

Host.—*Hemileuca oliviae*.

Type.—Cat. No. 18331, U.S.N.M.

Six females and eight male specimens reared by W. F. Schlupp from the eggs of the above named host and recorded under Webster No. 5054, Bureau of Entomology.

Family PTEROMALIDAE.

Subfamily PTEROMALINAE.

TRIMEROMICRUS, new genus.

Runs to *Neocatolaccus* in Ashmead's key and also in that of Nickolas Kourдумoff, but may be readily separated from that genus by the venation and the lack of appressed hairs on the thorax.

Antennae inserted on the middle of the face, with three ring-joints and a distinctly jointed club; pedicel about as long as the first funicle joint; joints of the funicle subequal and subquadrate; mandibles each with four very short teeth; eyes ovate and practically bare; head from in front not longer than broad, the clypeocular line a little longer than half the height of the eyes, cheeks rounded; seen from above the head is narrow antero-posteriorly, the occiput only slightly concave and immargined, ocellocular line about equal to the lateral ocellar line, the postocellar line fully twice the length of the ocellocular line; face below the antennae not curved under; pronotum short and as wide as the mesonotum; scutellum without a cross furrow; propodeum short, without a neck, the spiracular sulci and lateral folds distinct, spiracles distinctly elliptical; wings bare at base, the marginal and postmarginal veins nearly equal, the stigmal about two-thirds the

length of the postmarginal; legs normal; abdomen conic-ovate, not wider than the thorax, its first dorsal segment comprising about one-fourth of its total length.

Type of the genus.—*Trimeromicrus maculatus*, new species.

TRIMEROMICRUS MACULATUS, new species.

Female.—Length, 1.25 to 1.8 mm. Head and thorax closely punctate, the punctures of the vertex finer than those of the face, punctures on the mesoscutum before the base of the scutellum larger than elsewhere on the thorax; propodeum shining, with very faint reticulations, the median carina distinct and the lateral folds terminating basally in a broad deep fovea; abdomen with the first dorsal segment smooth, segments 2, 3, and 4 laterally and nearly all of 5 and 6 with faint reticulate lines. Head aeneous, the face more or less purplish or blackish in some lights; antennal scape pale, the pedicel and flagellum brownish testaceous, thorax black, tinged with aeneous, with four metallic blue-green or bright aeneous spots on the mesoscutum, one anteriorly on each side of the median line and another on the scapulae; base of the scutellum and axillae also often tinged with metallic; propodeum green or brassy; wings hyaline, the venation pale, apex of the submarginal vein and the stigmal knob usually darker; all coxae, trochanters, and femorae black; tibiae variable, brownish to black with the bases and apices yellow, the front tibiae often wholly yellow; all tarsi except the apical joint yellow; first dorsal abdominal segment brassy-green, the following segments green, broadly bordered apically with purplish black.

Male.—Antennal pedicel a little shorter than the first funicle joint; head and thorax aeneous, the latter without differentiated spots on the mesoscutum; marginal vein slightly shorter than the postmarginal; legs variable in color, sometimes entirely reddish-yellow except the coxae but more frequently with the femorae more or less brownish, and often with all the femorae brown and the tibiae brownish, the apices of tibiae and the tarsi always reddish-yellow; abdomen ovate, the dorsal segments beyond the first greenish-black without black apical bands. Otherwise like the female.

Type-locality.—Yuma, Arizona.

Type.—Cat. No. 18332, U.S.N.M.

Many specimens from the type-locality reared by T. D. Urbahns from alfalfa seed-pods infested with *Brucophagus funebris*, and recorded under Webster No. 7202, Bureau of Entomology, United States Department of Agriculture.

EUPTEROMALUS SARCOPHAGAE, new species.

Female.—Length, 1.9 mm. Dark green to somewhat aeneous; scape and legs excepting coxae reddish-yellow, apical tarsal joint brown; head and thorax with close thimble-like punctures; abdomen smooth conic-ovate.

Very similar to *Eupteromalus nidulans* Foerster, from which it differs principally as follows: Antennal flagellum black, the pedicel not longer than the two ring-joints and the first joint of funicle combined; apex of scutellum usually more faintly sculptured than the remainder of the scutellum, often slightly shining with shallow reticulate punctures, never with the three or four transverse rows of punctures at the apex larger and deeper than the others; propodeal median carina incomplete or wanting, never distinct and complete; stigmal vein very nearly as long as the marginal.

Male.—Similar to the female but with the antennal flagellum brownish-yellow, the abdomen scarcely longer than broad, its first segment wider at apex than the base of the second, segments beyond the first together scarcely longer than the first.

Type-locality.—Dodge City, Kansas.

Host.—*Sarcophaga kellyi*.

Type.—Cat. No. 18333, U.S.N.M.

Six females and one male from the type-locality, reared by E. O. G. Kelly and recorded under Webster No. 9946, Bureau of Entomology, United States Department of Agriculture.

HABROCYTUS MEDICAGINIS, new species.

Female.—Length about 1.7 mm. Head and thorax closely punctate, the punctures on the medial portion of the mesoscutum slightly larger than those on the scapulae and scutellum; antennae with two ring-joints; pedicel and first funicle joint, excluding the ring-joints, about equal; following funicle joints a little longer than the first and a trifle longer than broad; viewed from in front the head is broader than long, the clypeal region with converging striae and a deep median sinus on the anterior margin; viewed from above the head is slightly broader than the thorax, narrow antero-posteriorly, the occiput slightly concave, the ocellocular line longer than the lateral ocellar line, the lateral ocellar line not equal to half the postocellar line; pronotum strongly transverse with a sharp margin anteriorly; propodeum short, without a neck, with a median carina and lateral folds, the region between the lateral folds more or less distinctly wrinkled and with a fovea-like depression at the base and another at the apex of the fold; the region outside the lateral folds is usually more faintly sculptured with indistinct lines; propodeal spiracles elliptical; marginal and postmarginal veins subequal, the stigmal one-third shorter; abdomen conic-ovate, about as long as the head and thorax and nearly smooth, the dorsal segments beyond the first with very faint transverse lines. Head and thorax aeneous; antennae brown, the scape slightly paler beneath; wings hyaline; all coxae aeneous like the thorax, all trochanters and femorae black with an aeneous tinge; tibiae and tarsi usually reddish yellow, the

former often brownish except at apex; apical joint of all tarsi dark; abdomen polished aeneous.

Male.—Unknown.

Type-locality.—Glendale, California.

Type.—Cat. No. 18334, U.S.N.M.

Twenty-five specimens from the type-locality, reared by T. D. Urbahns from alfalfa seed pods infested with *Brucophagus funebris*, and recorded in the Bureau of Entomology under Webster No. 6044.

Family EULOPHIDAE.

Subfamily ENTODONINAE.

DEROSTENUS FULLOWAYI Crawford.

Several specimens which are believed to be this species have been reared by C. N. Ainslie from *Agromyza parvicornis* at Elkpoint, South Dakota, and are recorded under Webster No. 8870, Bureau of Entomology. The stigmal cloud in these specimens as well as in the type series of *D. fullowayi* in the United States National Museum varies all the way from very distinct to entirely absent, and it is doubtful whether the species is distinct from *D. variipes* Crawford, which was described from a single specimen.

Subfamily ELACHERTINAE.

EUPLECTRUS INSUETUS, new species.

Female.—Length about 2 mm. Black; face slightly aeneous; scape, mandibles, legs except middle and hind coxae, and the first abdominal segment above and below pale yellow; antennal flagellum brownish. Eyes distinctly hairy; occiput rugulose; vertex more or less wrinkled; frons and face faintly reticulated, shining, with scattering large round punctures on the frons; first funicle joint distinctly longer than the pedicel; joints 2, 3, and 4 of the funicle shorter, the fourth about as long as wide; club shorter than the two preceding funicle joints combined. Pronotum and mesoscutum scaly punctate, the latter without a median carina, the parapsidal grooves distinct but not deeply impressed; scutellum and axillae very distinctly and closely striated; metanotum polished; propodeum polished with a strong median carina and deep lateral folds, the spiracles placed almost in the folds; pleurae mostly smooth or very faintly sculptured, the prepectus distinctly punctate; hind coxae with fine reticulate lines; first joint of the hind tarsi much shorter than the second and shorter also than the third; longer of the hind tibial spurs a little longer than the first tarsal joint; wings hyaline the venation normal; abdomen short ovate, much shorter than the thorax and perfectly smooth.

Male.—Unknown.

Type-locality.—Lakeland, Florida.

Host.—*Lorema accius*.

Type.—Cat. No. 18335, U.S.N.M.

Five females from the type-locality, reared from the above-named host by G. G. Ainslie and recorded in the Bureau of Entomology, United States Department of Agriculture, under Webster No. 9498.

This species is easily separated from the other American forms by the short first joint of the tarsi and the short tibial spurs in which it resembles certain oriental species.

Subfamily EULOPHINAE.

DIAULINUS INSULARIS, new species.

Female.—Length about 1.1 mm. Similar to *Diaulinus pulchripes* Crawford, from which it may be separated by the stronger and deeper punctation of the mesoscutum and scutellum, by the furrows of the scutellum not being nearly as far apart as the length of the scutellum, by the propodeum being obviously reticulated, though very finely so, by the marginal vein being slender, the postmarginal a little longer than the stigmal, and by the narrower bands of black on the tibiae, these rarely extending much beyond the middle of the tibiae. Readily distinguished from *begini* Ashmead by the stronger sculpture and the broader bands on the tibiae.

Blue-green with brassy reflections, the latter strongest on the propodeum and base of the abdomen; antennal scape pale except at extreme apex, the pedicel and flagellum brown; punctures of the scutellum slightly finer than those of the mesoscutum but very distinct, parallel furrows of the scutellum about as far apart as half the length of the scutellum; wings hyaline; all femorae blackish at base, their apices broadly white or whitish; all tibiae banded with black, the black band extending to or a very little beyond the middle, a narrow band at the extreme base and the apical half whitish; two apical joints of the tarsi dark; abdomen mostly smooth.

Male.—Essentially like the female.

Type-locality.—Rio Pedras, Porto Rico.

Host.—*Agromyza inaequalis* Malloch.

Type.—Cat. No. 18336, U.S.N.M.

Described from nine females and four males from the type-locality reared by T. H. Jones.

Subfamily TETRASTICHINAE.

CERATONEURA PRETIOSA, new species.

Agrees with the description of the genus except that the scutellum shows two faint longitudinal grooves similar to those in species of *Tetrastichus* but less distinct than in that genus.

Female.—Length about 2.25 mm. Antennal pedicel about two-thirds the length of the first funicle joint; ring joints each nearly as long as thick; first joint of funicle the longest of the funicle joints, about twice as long as thick, third joint the shortest and scarcely one

and one-half times as long as thick; face below with prominent striae converging toward the clypeus; upper part of face, vertex, temples and occiput with very fine reticulate-punctate sculpture; thorax sculptured like the head, only more distinctly; propodeum with a well defined median carina and sculptured like the scutellum, only somewhat less distinctly; wings hyaline, the postmarginal vein absent, marginal vein of the hind wing ending in a small rounded knob; abdomen shorter than the head and thorax, ovate, mostly smooth but with the apical segments faintly reticulate above, petiole short. General color pale yellow, tinged with greenish on the dorsum and spotted with black as follows: A spot on the occiput, median lobe of the mesoscutum except lateral margins and apex, basal spot on each scapula, basal spot on each axilla, propodeum basally, spot on the mesosternum, abdominal petiole, and dorsal tergites 2, 3, and 4 for the most part. A blotch medially on the scutellum and most of the propodeum usually brownish.

Male.—Funicle appearing 5-jointed, the club 2-jointed; first funicle joint about one and one-half times as long as thick; following joints subequal and nearly three times as long as thick; abdomen spatulate and mostly black, the extreme apex yellow. The funicle is really but 3-jointed, the first ring-joint being greatly elongate and the basal joint of the club resembling the funicle joints.

Type-locality.—Brownsville, Texas.

Type.—Cat. No. 18337, U.S.N.M.

Twenty specimens reared by E. G. Smyth from galls on *Mimosa* and recorded under Webster No. 6480, Bureau of Entomology.

Genus TETRASTICHUS Haliday.

According to Kourdumoff, typical species of *Tetrastichus* have only a single stiff bristle on the upper side of the submarginal vein. Those having more than one such bristle he places in the genus *Geniocerus*. In *Geniocerus* as thus constituted will fall species having two, three, four, five, six, or even a greater number of such bristles and which otherwise can scarcely be separated from species having but one bristle. The writer can furnish no evidence that the number of these bristles varies within any given species, but it is evident that the division is by no means a natural one. Acceptance of *Geniocerus* as a good genus would necessitate changing the generic name of the majority of the American species, which under the circumstances does not seem advisable. It is the intention of the writer, therefore, to treat *Geniocerus* as a synonym of *Tetrastichus*, at least until some more satisfactory character can be found to separate them. The presence of but one bristle in some of the species does afford a convenient means of separating the species of *Tetrastichus* into two groups and is therefore welcome.

The following key is believed to include all of the known species of *Tetrastichus* from the United States having only one bristle on the dorsal side of the submarginal vein.

Key to some North American species of Tetrastichus.

1. Legs all pale; antennae unusually long, the flagellum twice the length of the face
..... *euplectri*, new species
Femora, at least, black or blackish; antennae shorter..... 2
2. Antennal club short, scarcely longer than the last funicle joint and distinctly wider;
first funicle joint nearly twice as long as the pedicel; propodeum strongly punctate..... *scolyti* Ashmead.
Club much longer than the last funicle joint and scarcely wider..... 3
3. Abdomen slender, narrower than the thorax and produced apically, longer than the head and thorax..... *productus* Riley.
Abdomen as broad as the thorax, not especially produced apically and rarely longer than the head and thorax..... 4
4. Lineolation of the thorax indistinct, very fine and shallow; first funicle joint apparently not much longer than the pedicel..... *theclae* Packard.
Lineolation of the thorax deeper and more distinct; first funicle joint distinctly longer than the pedicel..... 5
5. Face obscurely sculptured, nearly smooth; body black, femorae dull brownish
..... *johnsoni* Ashmead.
Face distinctly finely sculptured and with a number of large shallow round punctures on the frons and along the inner orbits; body metallic blue or green; femorae black or tinged with metallic..... 6
6. Third funicle joint not much longer than wide; scape and pedicel metallic blue-black; body deep blue; marginal vein somewhat thickened.
..... *asparagi* Crawford.
Third funicle joint nearly twice as long as broad and equal to the second; scape and pedicel yellowish; body color green; marginal vein scarcely thickened..... *hylotomae* Ashmead.

TETRASTICHUS EUPLECTRI, new species.

Female.—Length, 1.5 mm. Antennae elongate, cylindrical, the club not enlarged; ring-joint minute; pedicel about half as long as the first funicle joint; funicle 3-jointed, the first joint about three times as long as wide, second a little longer than the first, third shorter than the first; club 3-jointed, the first joint about twice as long as wide, second a little shorter, third small. Head obscurely lineolate; mesoscutum and scutellum with fine shallow lineolation, more apparent than on the face, parapsidal grooves deeply impressed, median groove of mesoscutum distinct; propodeum strongly and closely punctate with a median carina, the lateral folds present but not deep; submarginal vein with a single stiff bristle above, postmarginal vein obsolete; abdomen smooth, conic-ovate, about as long as the head and thorax. Head, thorax, and abdomen blue-green; antennae dark brown or black, the scape a little paler below; all coxae concolorous with the thorax, remainder of the legs pale yellow, the apical tarsal joint dark.

Male.—Similar to the female except that the antennal club is more elongate, being about as long as the funicle, its last joint as long and

as wide as the second and terminating in a spine; the first dorsal segment of the abdomen is pale yellowish except at base.

Type-locality.—Tullulah, Louisiana.

Host.—*Euplectrus platyhypenae* Howard.

Type.—Cat. No. 18338, U.S.N.M.

Two female and two male specimens reared by R. A. Vickery and recorded in the Bureau of Entomology under Webster No. 6439.

The long antennae, punctate propodeum, and pale legs distinguish this species from any of the other American species, having only one bristle on the upper side of the submarginal vein.

TETRASTICHUS HAGENOWI Ratzeburg.

Tetrastichodes floridanus ASHMEAD.

In the United States National Museum are specimens of the above-named species reared from the eggs of *Blatta* species, at Baton Rouge, Louisiana. Comparison of the types of *Tetrastichodes floridanus* Ashmead with these specimens shows them to be identical. The latter species is therefore a synonym of Ratzeburg's species.

TETRASTICHUS VENUSTUS, new species.

Female.—Length, 1.5 mm. Head and thorax obscurely lineolated; funicle joints subequal, the first slightly longer than the pedicel; club a little broader than the funicle, 3-jointed, and about as long as the two preceding funicle joints; median groove of the mesonotum very fine; parallel grooves of the scutellum distinct; propodeum obscurely sculptured; wings hyaline, the submarginal nervure with several bristles on the upper side; abdomen not longer than the head and thorax, thick dorso-ventrally at base and slightly conical. Body color pale orange-yellow variegated with black; vertex yellow; face, cheeks, occiput and spot surrounding the ocelli black; prothorax except laterally, large spot on the median lobe of the mesoscutum, basal spot on scapulae, basal spot on axillae, propodeum entirely, underside of the thorax, mesopleurae except the prepectus, and the abdomen, except the first and second dorsal tergites, black; all coxae and the basal half of the hind femorae black, the median and front femorae also blackish basally; rest of the head and thorax pale orange-yellow.

The color of this species is evidently quite variable. In paratype (a) the head, except the cheeks and occiput, is entirely yellow and the propodeum yellowish laterally. Paratype (b) is like the type, except that the median and front femorae are deep black on the basal half like the hind femorae.

Type-locality.—Corcoran, California.

Type.—Cat. No. 18339, U.S.N.M.

Three female specimens from the type-locality, reared by T. D. Urbahns from alfalfa seed-pods infested with *Brucophagus funebris* and recorded in the Bureau of Entomology under Webster No. 6712.

TWO NEW SOUTH AMERICAN JAGUARS.

By N. HOLLISTER,

Assistant Curator, Division of Mammals, United States National Museum.

The series of jaguars in the collection of the United States National Museum now includes, besides numerous zoological park specimens, the skulls of 36 wild-killed animals. A study of this material gives a very good idea of the individual variation in the skull, and of some of the local forms of this great cat. In addition to the three forms recognized by Dr. E. A. Mearns from north of Panama, three well-marked South American species are represented in the collection, two of which appear to be without names. The most important characters distinguishing these forms were pointed out by Doctor Mearns in his paper.¹

FELIS PARAGUENSIS, new species.

Type.—United States National Museum No. 4128, skull of male adult (basal suture closed); collected in Paraguay by Capt. T. J. Page, United States Navy. Catalogued June, 1860.

Characters.—Skull largest of the jaguars, much larger than skull of *Felis onca* from Brazil (and exceeding in measurements the largest Corean tigress skull examined), elongated and comparatively low crowned, with very high and strongly developed sagittal crest; audital bullae large and greatly inflated, angular and flattened on surfaces, completely filling space to the mastoid and paroccipital processes, almost twice the bulk of the bullae in any Brazilian specimen. Teeth actually slightly larger, but relatively of about same size as in *onca*.

Measurements.—Type skull compared with a slightly older male from Santarem, Brazil, the latter in parentheses: Greatest length, 303 (269) mm.; condylobasal length, 265 (234); zygomatic breadth, 196 (183); median line nasals, 61.7 (56.6); center of crown to tip of premaxillary bones, 146 (137); center of crown to maxillary tuberosity, 117 (108); audital bulla, 40.5 by 37 (30.2 by 29.8). Teeth: Length pm^3 – pm^4 , 48.3 (45.2); upper carnassial, 28.8 by 15.2 (26.6 by 15.2). Skull of adult female from Paraguay: Greatest length, 248 mm.; condylobasal length, 220; zygomatic breadth, 179; length pm^3 – pm^4 , 42.5.

Remarks.—This form is based on two skulls from Paraguay. These have been compared with six skulls of true *onca* from Brazil and Venezuela, all of which, with one exception, are very uniform in

¹ The American Jaguars, Proc. Biol. Soc. Washington, vol. 14, pp. 137–143, Aug. 9, 1901.

size and characteristics, including the presence of the wide sulcus between the mastoid process and the audital bulla. The single exception, an adult male skull collected by Captain Page at Lake Ubiraba, between Bolivia and Matto Grosso, Brazil, August, 1859, resembles the skulls from the Amazon region in every particular, except that it is much higher crowned (center of crown to maxillary tuberosity, 114.5) and has considerably greater postorbital and interorbital breadth. It shows no approach in characters toward the Paraguay skulls.

Fitzinger¹ based a name, *alba*, principally on references to accounts of jaguars from Paraguay, but the name is preoccupied by *Felis alba* Fischer² for a tiger. The *Felis nigra* of Erxleben is a synonym of *Felis onca*.

FELIS NOTIALIS, new species.

Type.—United States National Museum No. 4361, skull of [male] adult (basal suture obliterated); collected at San Jose, Entre Rios, Argentina, August, 1860, by Capt. T. J. Page, United States Navy.

Characters.—Skull small, very much smaller than in the neighboring form, *Felis paraguensis*, and slightly less in size than in true *onca*, much lower crowned and less arched; interorbital constriction less; nasals longer; antorbital foramina more rounded, less oval; squamosal arm of zygoma weaker; anterior opening of nares smaller, more rounded; audital bullae very low and little inflated, with wide space between them and rims of mastoid and paroccipital processes. Premolars very large, larger than in the much greater Paraguay form, but canines relatively smaller.

Measurements.—Type skull: Greatest length, 264 mm.; zygomatic breadth, 176; median length nasals, 65.3; center of crown to tip of premaxillary bones, 141; center of crown to maxillary tuberosity, 102. Teeth: Length pm^3 – pm^4 , 49.9 [in male *onca*, 43.8–47.5]; upper carnassial, 30.7 by 15.5 [in *onca* 26.6–28.2 by 14.6–15.3].

Remarks.—This form is based on a single specimen. Compared with six skulls of true *onca*, this specimen is at once distinguishable by its much larger carnassials and the peculiarly low audital bullae. The form represented is even more widely different from its nearest neighbor, the giant Paraguay species with the swollen bullae, than from the Brazilian *Felis onca*.

EXPLANATION OF PLATE 5.

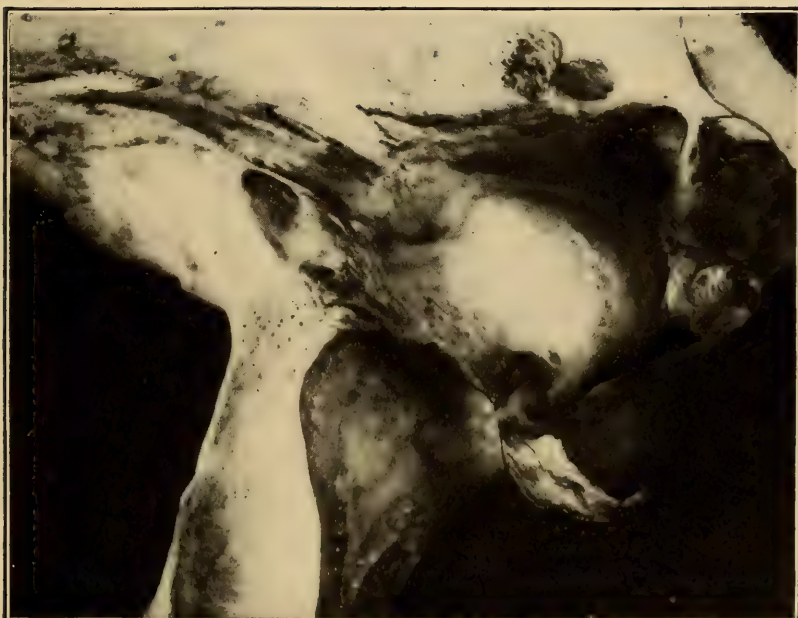
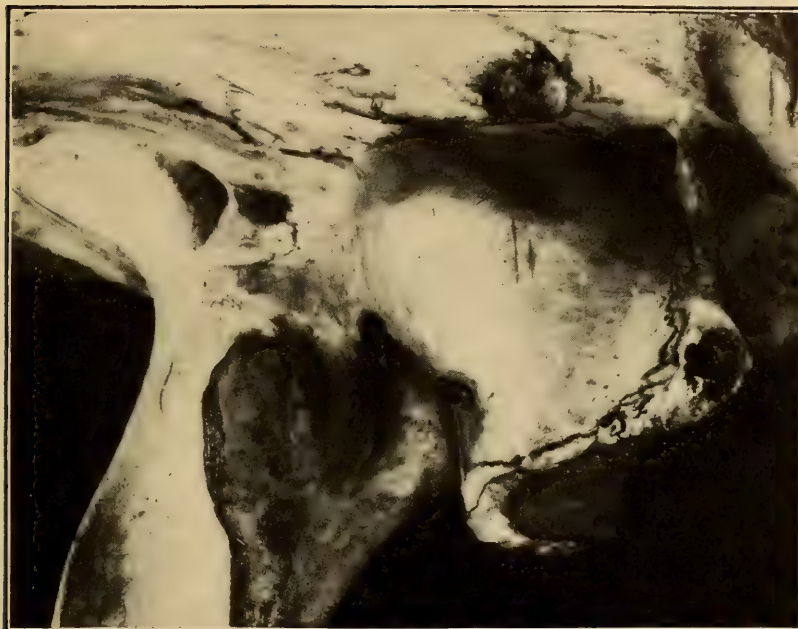
Audital bullae of jaguars (natural size).

Fig. 1. *Felis onca*, Cat. No. 49393, U.S.N.M., Amazon River near Santarem, Brazil. Collected by Clarence B. Riker.

2. *Felis paraguensis*, Cat. No. 4128, U.S.N.M., Paraguay. Collected by Capt. T. J. Page. Type-specimen.

¹ Sitz.-ber. Kais. Akad. Wiss. Wien, vol. 59, 1 Abth., pp. 218–220, 1869.

² Syn. Mamm., p. 566, 1829.



AUDITAL BULLAE OF JAGUARS.

FOR EXPLANATION OF PLATE SEE PAGE 170.

REPORT ON SOME PARASITIC AND PREDACEOUS DIPTERA FROM NORTHEASTERN NEW MEXICO.

By W. R. WALTON,

Of the Bureau of Entomology, United States Department of Agriculture.

The diptera noted and described in this paper were all collected in Colfax County, New Mexico. With but few exceptions, they were taken during the latter half of July and the first half of August, 1913. The work was undertaken in connection with an investigation of the New Mexico range caterpillar (*Hemileuca olivæ* Cockerell) at present being carried on by the United States Department of Agriculture, Bureau of Entomology, under the immediate supervision of Prof. F. M. Webster, expert in charge of cereal and forage insect investigations.

The purposes of these collections were: First, to ascertain what species of parasitic diptera are present throughout the area most infested by *Hemileuca* with a view to their utilization in the combat against this insect. Second, to facilitate the determination of such parasitic or predaceous diptera as may be used for experimental purposes in the range caterpillar investigations. The camp established for this latter project was used as a base of operations for these collections. This is situated on the open mesa and located about 18 miles almost due south of Raton, directly on the old "Santa Fé trail." Three miles to the westward, the foothills of the Sangre de Cristo Range of the Rocky Mountains rise abruptly to a height of from 1,500 to 2,000 feet above the plains. From thence westwardly, a continuous series of benches rises one above the other until the main range is reached, some 60 or 70 miles distant.

The valley is bounded on the north by the Raton Range and partially inclosed to the eastward by more or less isolated peaks rising to a height of 2,000 or 2,500 feet above the plains, which are said to lie at an elevation of about 6,500 feet, sea level datum. Several of the peaks are surrounded by extensive mesas, the level of which lie at an elevation of from 500 to 1,000 feet higher than the surrounding plain and possess a rather abundant vegetation.

One of these, namely, that of Eagle Tail Mountain, was explored and collections made. The insect fauna of the entire region worked

over is mainly that of the Upper Sonoran life zone. This of course merges into that of the transition zone on the slopes of the mountains and foothills.

That the insect life of this semiarid region is surprisingly abundant is attested by the large amount of material secured within a very limited period of time. That is to say, about 25 days, which period was materially reduced by inclement weather to not more than 20 days actual collecting.

Some 30 or more species of Tachinidæ were secured; several of these represent genera or species new to science. The most remarkable of these is the form described below as *Neodichocera tridens*, new species, giving rise to a new genus. This is a fissicorn tachinid, and the first species recorded from North America possessing three divisions of the third antennal joint.

The most abundant families of diptera found in the region explored are Bombyliidæ, Asilidæ, and Tachnidæ in the order named. The Bombyliidæ are the most generally distributed, with the Asilidæ second. On the other hand, the Tachinidæ, while abundant in species, are apparently much localized in distribution. Also, practically all of the species and individuals collected, excepting those from the immediate vicinity of water, are of small or medium size. Thus in the vicinity of the Red River, a mere brook during the warmer part of the summer, several large specimens of *Gonia capitata* were taken. Near irrigation ponds specimens of *Phorocera claripennis* were collected which are at least 3 times as large as most individuals collected on the dry mesa. Specimens secured upon the slopes of the foothills and also on the summit of Eagle Tail Mountain, where the precipitation is considerable, average much larger in size than those from the plains. This may be due to a greater abundance of host insects or to the presence of host species which do not exist on the more arid plains. Specimens of *Musca domestica* were seen near the summit of Eagle Tail, miles away from human habitations. One specimen of *Myiospila mediatubunda* was also taken about 100 feet below the summit.

Stomoxys calcitrans is abundant, widely distributed and extremely troublesome to man and beast during the warmer parts of the day. Strange to say, hordes of hungry mosquitoes sometimes appear after one of the furious rains which occasionally visit the plains. These follow one about in the burning sunshine and bite during the daytime, but are not very troublesome at night within the tents. No blood-sucking diptera other than those mentioned above were found.

The writer is greatly indebted to Mr. V. L. Wildermuth and other members of the range caterpillar camp for notes, specimens, and many courtesies extended and offers his hearty thanks to them one and all.

All types and specimens mentioned herein are deposited in the United States National Museum in Washington.

Since the insect fauna of the region explored is very little known a list of the species collected is included together with such annotations as are deemed of importance.

Family NEMISTRINIDAE.

RHYNCOCEPHALUS VOLATICUS Williston.

One specimen of this rare fly collected from awning in camp by Mr. Donald J. Caffrey, July 28.

Family BOMBYLIIDAE.

Genus EXOPROSOPA Macquart.

EXOPROSOPA ROSTRIFERA Jaennicke.

Exceedingly abundant everywhere on the mesa.

EXOPROSOPA DORCADION Osten Sacken.

Common but difficult to approach.

EXOPROSOPA PUEBLENSIS Jaennicke.

One specimen, July 30.

Genus ANTHRAX Scopoli.

ANTHRAX LATERALIS Say.

Very abundant on mesa.

ANTHRAX ALCYON Say.

Common during early August.

ANTHRAX BIGRADATA Loew.

One specimen August 5.

ANTHRAX EDITIA Say.

Common during early August.

ANTHRAX MOLITOR Loew.

One specimen August 6.

ANTHRAX ANNA Coquillett.

Abundant on mesa from late July to August 10.

ANTHRAX CYRTIS Coquillett.

Two specimens August 7; mesa.

Genus PHTHIRIA Meigen.

PHTHIRIA SULPHUREA Loew.

Two specimens on flowers of *Grindelia* near irrigation pond July 31.

Genus TOXOPHORA Meigen.

TOXOPHORA PELLUCIDA Coquillett.

One specimen from border of irrigation pond July 21.

Genus GERON Meigen.

GERON SENILIS Fabricius.

Abundant on mesa during early August.

Genus LORDOTUS Loew.

LORDOTUS GIBBUS Loew.

Common on mesa after August 1.

Family ASILIDAE.

Genus HETEROPOGON Loew.

HETEROPOGON SENILIS Bigot.

One specimen from Eagle Tail Mountain, 7,500 feet.

Genus MALLOPHORA Macquart.

MALLOPHORA GULDIANA Williston.

One specimen from foothills July 29.

MALLOPHORA CLAUSICELLA Macquart.

One specimen from mesa August 5.

Genus PROCTACANTHUS Macquart.

PROCTACANTHUS MILBERTII Macquart.

This large species swarms over the plains during the hottest part of the day. It feeds largely upon half-grown grasshoppers. One individual was found to have a medium sized stout skipper butterfly in its grasp.

Genus STENOPOGON Loew.

STENOPOGON PICTICORNIS Loew.

Very common on mesa. Recorded as eating *Hemileuca* by Mr. C. N. Ainslie but also feeds largely upon grasshoppers, butterflies, etc.

Genus OSPRIOCERUS Loew.

OSPRIOCERUS ABDOMINALIS Say.

Found rather commonly at all elevations. Flies heavily and is easily captured.

OSPRIOCERUS MINOS Osten Sacken.

Equally abundant and often found in company with the preceding species, of which it may be merely a color phase. A specimen had killed and was devouring another of the same species.

Genus ERAX Scopoli.

ERAX STAMINEUS Williston.

Rather common on the mesa during early August.

ERAX VARIPES Williston.

Equally common and found with the preceding species.

Genus DEROMYIA Philipi.

DEROMYIA PERPLEXA Back.

The commonest Asilid on the mesa during early August. One individual was devouring a beetle of the genus *Hister*.

Genus *ASILUS* Linnaeus.*ASILUS PRARIENSIS* Tucker.

From mesa; August.

ASILUS LEUCOPOGON Williston.

From mesa; August.

ASILUS TENEBROSUS Williston.

Abundant in a rocky canyon in foothills July 19.

Family *MUSCIDAE*.

While most of the species mentioned below are not known to be parasitic in habit, the record of their occurrence and habits in this comparatively little known region are deemed of sufficient importance to merit inclusion here.

Genus *PROTOCALLIPHORA* Hough.*PROTOCALLIPHORA CHRYSORRHAEA* Meigen.

Thirty specimens of this fly were reared from a fledgling of the horned lark (*Otocoris alpestris*) by Mr. Wildermuth June 11. The larvæ were contained in purulent sores on the sides of the body near the legs and on the neck. The bird, although weak and emaciated, was able to flutter away after the maggots were removed. It was first discovered by John R. Sandige.

Genus *CALLIPHORA* Desvoidy.*CALLIPHORA COLORADENSIS* Hough.

This species is common about prairie-dog towns on the mesa. It has the habit of flying into their burrows for some unknown purpose. After entering, the flies can often be heard buzzing, apparently deep down in the tunnel.

Genus *STOMOXYS* Geoffroy.*STOMOXYS CALCITRANS* Linnaeus.

Very abundant as before noted.

Genus *MUSCA* Linnæus.*MUSCA DOMESTICA* Linnaeus.

Abundant about Camp.

Genus *MUSCINA* Desvoidy.*MUSCINA STABULANS* Fallen.

Abundant about Camp.

Genus *PHORMIA* Desvoidy.*PHORMIA REGINA* Meigen.

Breeding in garbage pits in large numbers.

Genus ORTHELLIA Desvoidy.

ORTHELLIA CORNICINA Fabricius.

Present on the range.

Family SARCOPHAGIDAE.

Genus MICROCHAETINA v. d. Wulp.

MICROCHAETINA CINEREA v. d. Wulp.

A pair taken on the mesa August 10.

Family DEXIIDAE.

Genus RHYNCHIODEXIA Bigot.

RHYNCHIODEXIA FLAVOTESSELLATA, new species.

Plate 6, fig. 1.

Yellowish, opaque, wings hyaline, legs reddish, length 10-12 mm. Head at vibrissae as long as at base of antennae, inferior occiput swollen. Front in male one-fifth as wide as eye, in female distinctly wider than eye. Vitta dark brown, linear in male, less than one-half as wide as sides of front in female. Front in male olive gray. In female upper portion brown with whitish pollen, an olive gray quadrate patch enveloping base of antennae and extending nearly to anterior margin of eye. Face and cheeks in each sex brownish, thinly ochraceous pollinose, lower half of face on sides bearing a few scattered hairs.

Antennae in both sexes very short. In male less than one-half, in female slightly more than one-half length of facial plate. First and second joints yellow; third yellow at base, apical half black. Arista long plumose, at least twice length of third antennal joint. Facial depression narrower than sides of face, vibrissal angles approximated, vibrissae cruciate, situated fully the length of second antennal joint above oral margin. Ridges bristly on less than lowest fourth. Margin of face below vibrissae bearing a row of closely set slender macrochaetae. Cheeks slightly broader than one-half eye height, brownish with yellowish pollen. Proboscis brown, about one and one-fourth times height of head, lower half distinctly chitinated. Labella small, horny. Palpi yellow, slender, attached to proboscis at about one-third its length measured from base. Eyes bare. Thorax yellowish brown, ochraceous pollinose. Five longitudinal vittae visible, brown, the median and outer ones wide, the intermediate pair more grayish and narrow. Post-sutural bristles in these specimens three, sterno-pleural bristles three. Scutellum brown, ochraceous pollinose, bearing two pairs of long marginals and some smaller bristles. Also a pair of cruciate apical bristles. Abdomen elongate ovate, yellowish brown, pseudo-maculate with

yellowish, shining, pollen. First segment with a semicircular, black, subscutellar spot, destitute of median marginal bristles. Second, third, and fourth segments yellowish brown with a median, faint, blackish, band which becomes prominent in greasy specimens. These segments bear both discal and marginal macrochaetæ, the former sometimes arranged irregularly. Hypopygium reddish, nearly concealed in abdomen. Coxæ, femora, and tibiæ reddish; a brown patch appears on the under surfaces of knees in the posterior femora. Tarsi blackish, claws of male elongate, pulvilli smoky at base, paler at apices. Wings rather narrow, veins brown, costal spine obsolete. A slight brownish stain bordering the anterior cross vein. Apical cell distinctly open in male, in female sometimes nearly closed. Bend of fourth vein abrupt, without stump or wrinkle. Third vein bearing three or four weak, short bristles at base.

Habitat.—Eagle Tail Mountain, Colfax County, New Mexico. Described from four specimens. One pair taken in copulation and pinned together.

Type.—Female; Cat. No. 18342, U.S.N.M.

RHYNCHIODEXIA STRIATA v. d. Wulp.

Two specimens corresponding closely to Van der Wulp's figure and description from Eagle Tail Mountain.

Genus *ZELIA* Desvoidy.

ZELIA WILDERMUTHII, new species.

Plate 6, figs. 2 and 3.

Opaque cinerous, nowhere shining, wings grayish hyaline, legs reddish. Antennæ yellow. Length, 10–13 mm.

Head much higher than long, slightly longer at base of antennae than at vibrissæ. Cheeks two-thirds as wide as eye height, cinereous; a reddish yellow, irregular, reflecting stain running from lowest corner of eye to vibrissal angle. Front in female one and one-half, in male two-thirds as wide as eye. Median vitta of same width in both sexes, reddish brown, twice as wide at base of antennæ as at apex of ocellar triangle. Female bearing two pairs of orbitals, absent in male. Two pairs of ocellar bristles, present in male, the posterior pair much reduced in female. Frontal bristles rather weak, not extending below base of second antennal joint. Antennae slender, reddish yellow; in female three-fourths, in male two-thirds as long as face. Third joint concave on anterior margin. Arista reddish, thickly and finely plumose, in female longer than third antennal joint, second joint short. Second antennal segment bearing a long slender bristle nearly or quite one-half length of third antennal joint. Vibrissae situated on oral margin. Palpi and proboscis reddish yellow, the latter very short and fleshy. Genae and

parafacials naked, cinereous. Eyes bare. Thorax opaque, ochraceous, marked with four slender brown longitudinal vittæ. The inner pair slightly, the outer broadly interrupted at suture and vanishing before posterior third of post-sutural area. Scutellum opaque cinereous, its suture with the mesonotum narrowly shining black; bearing two pairs of long marginal and a long cruciate apical pair. Post-sutural bristles four; sterno-pleurals three. Abdomen (pl. 6, fig. 3) ochraceous cinereous, slightly wider than thorax at base, saggitate in form. Apex rather acute. Four segments visible, exclusive of the very short basal one, first segment bearing a median black spot which expands at base beneath scutellum, extending caudad almost to but not touching posterior margin of segment, usually inclosing a linear median ochraceous spot on its apical third; second segment bearing a faint median longitudinal band expanding and becoming more distinct at posterior margin of segment, which it does not touch. Third and fourth segments, including hypopygium, immaculate except at bases of principal macrochaetæ, which are surrounded by a blackish ring. In some specimens segments 1 and 2 bear triangular black spots at bases of lateral marginal macrochaetæ. First abdominal segment destitute of median marginal bristles, second segment bearing a stout pair of marginals. Third and fourth segments bearing both discal and marginal macrochaetæ. Hypopygium of the male visible, that of female concealed. Tibiæ and femora, including coxae, reddish, yellowish pollinose. Tarsi black, pulvilli dusky, front claws of male elongate. Squamae yellowish. Wings rather long, grayish hyaline. Longitudinal and cross veins margined with a scarcely perceptible brownish stain. Veins brownish. Costal spine obsolete. Bend of fourth vein abrupt, destitute of stump or wrinkle. Apical cell open in margin of wing and with a distinct neck at apex. Third vein bearing two or three bristles at base only. In greasy specimens (and *Dexiids*, usually become so) the median band on second abdominal segment appears distinctly black.

Habitat.—Open mesa, Koehler, New Mexico.

Type.—Female; Cat. No. 18341, U.S.N.M.

This species is usually found sitting upon the ground on low herbiage and is very common. One specimen seemingly identical with this standing in United States National Museum (from Custer County, California), as *melanocera* Desvoidy. The original description of that species says "Antennæ black," and is exceedingly brief. The present species has yellow antennæ and is evidently distinct.

Family TACHINIDAE.

Genus GYMNOSOMA Meigen.

GYMNOSOMA FULIGINOSA Desvoidy.

One robust specimen taken near irrigation pond.

Genus MYIOPHASIA Brauer and von Bergenstamm.

MYIOPHASIA SETIGERA Townsend.

A series of more than 40 specimens was taken on the mesa. This species at first glance resembles very closely some specimens of *M. aenea* taken in the northeastern portions of the United States. It is, however, usually more bristly as regards the sterno-pleural region, most of these specimens possessing three or more sterno-pleural bristles. Several of the individuals bear but two. An actual measurement of the angle included between the penultimate section of the fifth vein and the hind cross vein in a series of 20 specimens in this species gives an average of 114° . The same angle in a similar number of specimens of *M. aenea* taken in various parts of the north and east gives an average of 92° , a difference of 22° . Thus it appears that the excess of obliquity of the hind cross vein in *M. setigera* is a good specific character, much more stable in fact than the hairiness of the eyes, the presence or absence of a weak pair of marginal macrochaetæ on the second abdominal segment, or the closing or opening of the first posterior cell. These latter characters are all variable and unreliable within specific limits in this genus.

MYIOPHASIA ROBUSTA Coquillett.

A series of 15 specimens male and female collected on sunflowers in an arroyo on mesa. The type of this species, a large male, seems to be the only specimen mentioned in the literature; accompanying it in the National Museum collection are three specimens from Mexico City, Mexico. This is a very distinct species. The female has not been described, and as the sexes are dichroic, a description is appended herewith.

Female.—Uniform cinereous pollinose, abdomen slightly brassy. Front fully one and one-half times as wide as either eye, sides widely divergent below. Frontal vitta dark brown, occupying one-third of width of front at narrowest part. Parafacials wider than facial depression. Cheeks nearly two-thirds as high as eye, yellowish gray pollinose. Antennæ reddish, third antennal joint on anterior edge brown, about one and one-half times as long as second joint. Arista incrassated at extreme base, microscopically pubescent. Proboscis and palpi nearly black. Two pairs of orbital bristles, parafacials bearing a distinct row of large hairs extending from base of antennæ to the lower edge of eye, other scattered hairs also present. A pair of cruciate frontals immediately before ocelli. Eyes usually

bearing long but scattered hairs on the lower half; some specimens have a few hairs upon the upper portion of eyes; in one specimen eyes almost nude.

Thorax and scutellum opaque cinereous pollinose, two pairs of longitudinal vittæ visible, inner pair narrow, distinct anterior to suture, obsolete posterior thereto. Outer vittæ reduced to mere spots. Post-sutural macrochaetæ three, sterno-pleural bristles usually four. Scutellum bearing three pairs of marginals, the apical pair being longest. Abdomen ovate, cinereous pollinose with a slightly brassy shine. A weak median macrochaeta, or sometimes two, distinguishable on margin of second abdominal segment. Legs, including tarsi, entirely black. Wings hyaline. Veins yellowish, first posterior cell either distinctly open or barely closed in costa close to but before the wing tip. The angle of the posterior cross vein measures 115° , the average of 10 specimens, male and female. Length, 6–8 mm. Described from six specimens. The male differs from female in that he is shining black excepting the front, base of second and all of third and fourth abdominal segments, which are cinereous pollinose.

WEBSTERIANA, new genus.

Plate 6, fig. 4.

Palpi present well developed, antennæ reaching only slightly below middle of the face, first longitudinal vein bare, costal spine long, costa with a narrow but distinct break at tip of auxiliary vein. Sides of face bearing a row of five or six slender proclinate macrochaetæ extending from base of antennæ to near lower corner of eye. First posterior cell closed, petiolate ending well before tip of wing. Hind cross vein at middle of discal cell or slightly before. Cheeks less than one-half eye height, lower occiput swollen. Head nearly as long as vibrissæ as at base of antennæ, eyes of male distinctly hairy, in female bearing indistinct scattered hairs. Vibrissæ situated about the length of second antennal joint above oral margin.

Type of the genus.—*Tricogena costalis* Coquillett.

This genus is named in honor of Prof. F. M. Webster. Mr. Coquillett's specimen was a unique female in bad state of preservation. My series of 10 specimens, including both sexes, shows conclusively that it can not be placed in *Tricogena* Rondani. It is distinct from *Metachæta* by its bare first vein and from *Rhinophora* by the row of macrochaetæ on cheeks, bare arista, etc.

WEBSTERIANA COSTALIS Coquillett.

Plate 6, fig. 5.

Slender, black, silvery pollinose, wings milky, costal margin infuscated. Length 5 mm. Front in female at narrowest part same width as eye, in male one-half as wide. Two pairs of orbitals in the female, absent in male. Entire head exclusive of frontal vitta hoary frosted

with pollen. Frontal vitta opaque black. Antennæ black, third joint in female distinctly longer than second, in male about same length as second. Palpi brownish, proboscis dark brown. Arista black, bare, bulbous at extreme base, second joint not longer than broad. Lower occiput with whitish hairs. Thorax and scutellum black, uniform frosty pollinose. Vittæ almost obsolete. Post-suturals three, sterno-pleurals two. Abdomen elongate ovate, shining black, bases of second and third segments silvery pollinose, first three segments bearing marginal macrochaetæ only, fourth bearing discals also. Legs, including tarsi, black, middle tibiæ bearing two macrochaetæ, one long and one short, on the front side near middle. Claws of male elongate. Pulvilli white. Calypters white. Wings milky, strongly infuscated along costal border extending dilutely into first posterior cell, which is closed and petiolate. The petiole slightly longer than anterior cross vein, third vein bearing a row of from two to five rather long bristles on basal third. Veins black excepting fifth longitudinal and those inclosing second and third basal cells, which are pale. Anal vein does not reach posterior margin of wing. Ten specimens, male and female, collected on sunflowers August 1-12 on prairie. This pretty species presents an odd sight in nature, as it has the habit of extending the wings at right angles to the body, walking about with them in this position like some *Ortalids*, a habit unusual among Tachinidæ.

Genus TACHINOPHYTO Townsend.

TACHINOPHYTO DUNNINGII.

Several specimens from mesa, the first record of this species from the southwest.

Genus LEUCOSTOMA Meigen.

LEUCOSTOMA SENILIS Townsend.

Three specimens from mesa July 24. This species is undoubtedly distinct from *neomexicana* Townsend, which Mr. Coquillett placed in the synonymy.

Genus CLYTIOMYIA Rondani.

CLYTIOMYIA FLAVA Townsend.

A male and two females from sunflowers August 1 to 12.

Genus HETEROPTERINA Macquart.

HETEROPTERINA NASONI Coquillett.

A few specimens of this minute species were collected on mesa. An unpublished note by C. N. Ainslie, bearing Webster No. 6112 in the files of the Bureau of Entomology, records the rearing of two specimens of this fly from grasshoppers at Payson, Utah, July 10, 1911. The first indication of its host relations.

Genus *PLAGIOPROSPHERYSA* Townsend.*PLAGIOPROSPHERYSA PARVIPALPUS* v. d. Wulp.

A series of 12 specimens collected on mesa; these vary in size from 5 to 7 mm.

Genus *PLAGIA* Meigen.*PLAGIA AMERICANA* v. d. Wulp.

On mesa August 6.

Genus *SIPHOPLAGIA* Townsend.*SIPHOPLAGIA ANOMALA* Townsend.

One male from sunflower August 10.

Genus *SENOTAINIA* Macquart.*SENOTAINIA TRILINEATA* v. d. Wulp.

A series of eight specimens collected. It is abundant here, but sits on the ground on stones and is difficult of capture.

SENOTAINIA RUBRIVENTRIS Macquart.

Found in company with the preceding species.

Genus *PACHYOPTHALMUS* Brauer and von Bergenstamm.*PACHYOPTHALMUS FLORIDENSIS* Townsend.

A series of 10 specimens from an arroyo on mesa. If the extra row of weak frontal bristles be disregarded, this species will go into *Senotainia*. Occasionally one finds a specimen in which the outer rows of bristles are nearly obsolete. Thus a few specimens of this species were found standing in the United States National Museum collection under *Senotainia rubriventris*, from which species it is easily distinguished by its bright yellow antennæ and black hypopygium. One specimen bearing label "Coll. Townsend, Brownsville, Texas, June," has the abdomen reddish in ground color, but is otherwise identical with *floridensis*.

Genus *SIPHOSTURMIA* Coquillett.*SIPHOSTURMIA ROSTRATA* Coquillett.

A pair taken on the dry mesa about flowers. This is the first record of this species from the arid southwest.

Genus *EXORISTA* Meigen.*EXORISTA PYSTE* Walker.

In the foothills, among the scrub oaks, early in August, this species was present in swarms. Their high-pitched, mosquitolike note could be heard many feet distant. No insect which might serve as a host could be discovered on the oaks at this time, but Mr. Wildermuth's notes show that these bushes had been heavily infested by a species of *Malacosoma* a few weeks previously.

Genus PHOROCERA Desvoidy.

PHOROCERA CLARIPENNIS Macquart.

The most widely distributed *Tachinid* to be found on the mesa. Often attracted to one's person, possibly by perspiration, alighting on the clothing and even upon the hands. Varies enormously in size. A series of 50 specimens collected over a wide area and under varying conditions of moisture, etc. Reared by C. N. Ainslie and V. L. Wildermuth from *Hemileuca oliviae* Cockerill in New Mexico. Its percentage of parasitism in some restricted localities is very high on this host. One large female taken on summit of Eagle Tail Mountain, elevation 7,500 feet or more, August 3.

Genus NEOPALES Coquillett.

NEOPALES (LYDELLA) DORYPHORAE Riley.

Plate 7, fig. 6.

A series of 19 specimens collected in prairie arroyo July 20 to August 10. In proposing a new genus, namely, *Doryphorophaga*,¹ for the reception of this species Mr. Townsend says: "The eyes are thickly hairy. * * * The intermediate (second and third) abdominal segments bear discal bristles and the ventral carina and curved spine-like piercer, both of ordinary character, are present in the female." Examination of all available material shows these statements to be incorrect in part. The eyes are thickly hairy in the male as a rule, those of the female being so nearly bare in some cases as to require the utmost care in order to see the hairs at all. The intermediate segments of the abdomen seldom bear discal macrochaetæ in either sex and are almost invariably absent in the female. The "ventral carina" does not exist in the sense that we find it in *Compsilurd*, *Celatoria*, and *Chaetophleps*. In these genera there is present a distinct carina or compressed tubercle armed with greatly modified macrochaetæ forming toothlike spines projecting downward and backward.

In the species under discussion the carina, though present, is very slightly developed and indeed often concealed entirely, especially in freshly killed individuals. A piercer certainly exists, as Mr. Townsend says, also one of the New Mexican females upon dissection showed the presence of 22 fully developed and 15 undeveloped maggots measuring about one-third mm. in length and armed with a long, slender, curved mouth hook and the rows of spines described by Mr. Townsend; until further and more reliable external characters, especially in the case of the male, are discovered, it would seem expedient to retain the species in the genus *Neopales* (Phorocera of authors) for the present. Figures of the abdomens of this species, figure 6, and *Compsilurd concinnata*, figure 7, are afforded herewith for purposes of comparison. These are partially diagrammatic in that the minor vestiture is omitted.

¹ Proc. Ent. Soc. Wash., vol. 14, p. 164.

Genus STURMIA Desvoidy.

STURMIA ALBIFRONS Walker.

One female from mesa.

STURMIA BAKERII Coquillett.

Two males from summit of Eagle Tail Mountain resting on pinon pines.

STURMIA INQUINATA v. d. Wulp.

One specimen from mesa August.

Genus TACHINA Meigen.

TACHINA MELLA Walker.

Reared from *Malacosoma fragilis* Strand on scrub oak July 17, 1913, at Koehler, by Mr. Wildermuth, also from *Hemileuca oliviae* Cockerell by Messrs. Ainslie and Wildermuth.

Genus PHORICHAETA Rondoni.

PHORICHAETA CINEROSA Coquillett.

One specimen from flowers on mesa August 10.

Genus ARABA Desvoidy.

ARABA TERGATA Coquillett.

Two females from bottom of arroyo in mesa.

Genus GONIA Meigen.

GONIA CAPITATA De Geer.

Six large light colored specimens from vicinity of streams and ponds August 1-8.

Genus CHAETOGAEDIA Brauer and von Bergenstamm.

CHAETOGAEDIA CREBRA v. d. Wulp.

One female from summit of Eagle Tail Mountain August 3.

Genus NEODICHOCERA, new genus.

Closely related to *Diochocera*, Williston.

Palpi slender but otherwise normal, face bearing a row of rather strong macrochaetæ extending from root of antennæ to a point slightly below the lower corner of eye. Tip of apical cell ending distinctly before tip of wing, eyes strongly hairy (in male). Posterior end of hind cross vein nearer margin than to small cross vein. Distance from bend of fourth vein to posterior cross vein nearly one-half as great as that from small cross vein measured along fourth vein. Facial ridges bristly on lowest fifth; antennæ inserted at a point opposite upper corner of eye. Last segment at most eight times length of second, divided into three lobes, the inner one the stoutest and bent outward in a right angle at its apical fifth. Male destitute of orbital bristles. Penultimate joint of arista in male at least four times longer than broad, first joint subequal to it, attached to base of middle lobe of third antennal joint. Other head characters as shown in plate 7, figures 8-9.

Type of the genus.—*Neodichocera tridens*, new species.

NEODICHOCERA TRIDENS, new species.

Plate 7, figs. 8-12.

Black Sarcophagidlike, silvery gray pollinose. Length, 8-9 mm. Extreme tip of abdomen and visible hypopygium yellow. Head slightly broader than thorax. Frontal vitta bright reddish brown, exceedingly short, not longer than width of front at narrowest point. Ocellar triangle and sides of front black, gray pollinose, bearing a single frontal row on each side, outside of these sprinkled with fine black erect hairs to a point slightly below middle of eye. Orbital bristles absent. Cheeks about as wide as eye height, black, densely hairy, hairs merging into macrochaetae on anterior margins. Vibrissae strong, cruciate, placed on oral margin. Transverse impression of face well marked, brownish.

Proboscis brown, slightly longer than one-half height of head, palpi yellow. Antennæ nearly as long as face, first segment brown, projecting distinctly above level of front, second joint yellowish, bearing one unusually strong, proclinate macrochaeta on its lower front edge. Third joint brown, distinctly grayish pubescent, divided into three long lobes, the inner, the longest, the outer, the shortest. Arista nearly as long as third antennal joint, thickened almost to the tip, black, length of segments variable. Occiput excepting space above central foramen thickly gray pilose. Eyes densely hairy except along posterior margin. Thorax black, gray pollinose with four distinct black vittæ on the dorsum, extending to but coalescing immediately before scutellum. Scutellum rather small, rounded, black at base, piceous on apical two-thirds. Bearing three or four pairs of long marginals, also a strong discal pair. Dorso-central bristles four, sterno-pleurals two. One specimen bears a single long apical scutellar bristle. Abdomen ovate, black, pseudo-maculate, with a distinct black median vitta, gray pollinose. Segments 2 and 3 with a slight rufous tinge on sides. Fourth segment black at base, apical half and hypopygium yellowish red. First two segments destitute of discals and marginals on dorsum. Third bearing a median marginal pair. Hypopygium bearing black bristles. Legs, including tarsi, entirely black. Middle tibiae (pl. 7, fig. 10) bearing three strong macrochaetæ on front side near middle. Hind tibiae (pl. 7, fig. 11) coarsely pectinate with macrochaetæ. Calypters white, wings (pl. 7, fig. 12) hyaline, comparatively small, veins black, costal spine almost obsolete. Bend of fourth vein obtusely angular, destitute of stump or wrinkle. Apical cell distinctly open in margin before tip of wing. Base of third vein bearing five or six weak bristles.

Habitat.—Koehler, New Mexico.

Described from two males. Species resembles superficially *Dichocera lyrata* Williston, collected by Dr. J. M. Aldrich in Idaho 18 years ago,¹ but structurally quite distinct.

Type.—Cat. No. 18343, U.S.N.M.

¹ Ent. News, vol. 6, p. 29.

Genus PELETERIA Desvoidy.

PELETERIA ROBUSTA Wied.

One large specimen from foothills July 19. Two males from summit of Eagle Tail Mountain August 3.

Genus ECHINOMYIA Latreille.

ECHINOMYIA ALGENS Wied.

One large female collected on tent in camp, September, by Mr. Wildermuth.

EXPLANATION OF PLATES.

PLATE 6.

Fig. 1. *Rhynchiodesia flavotessellata*, head.

2. *Zelia wildermuthii*, head.

3. *Zelia wildermuthii*, abdomen, dorsal view.

4. *Websteriana costalis*, head.

5. *Websteriana costalis*, wing, dorsal view.

PLATE 7.

Fig. 6. *Neopales doryphoræ*, abdomen, lateral view.

7. *Compsilura concinnata*, abdomen, lateral view.

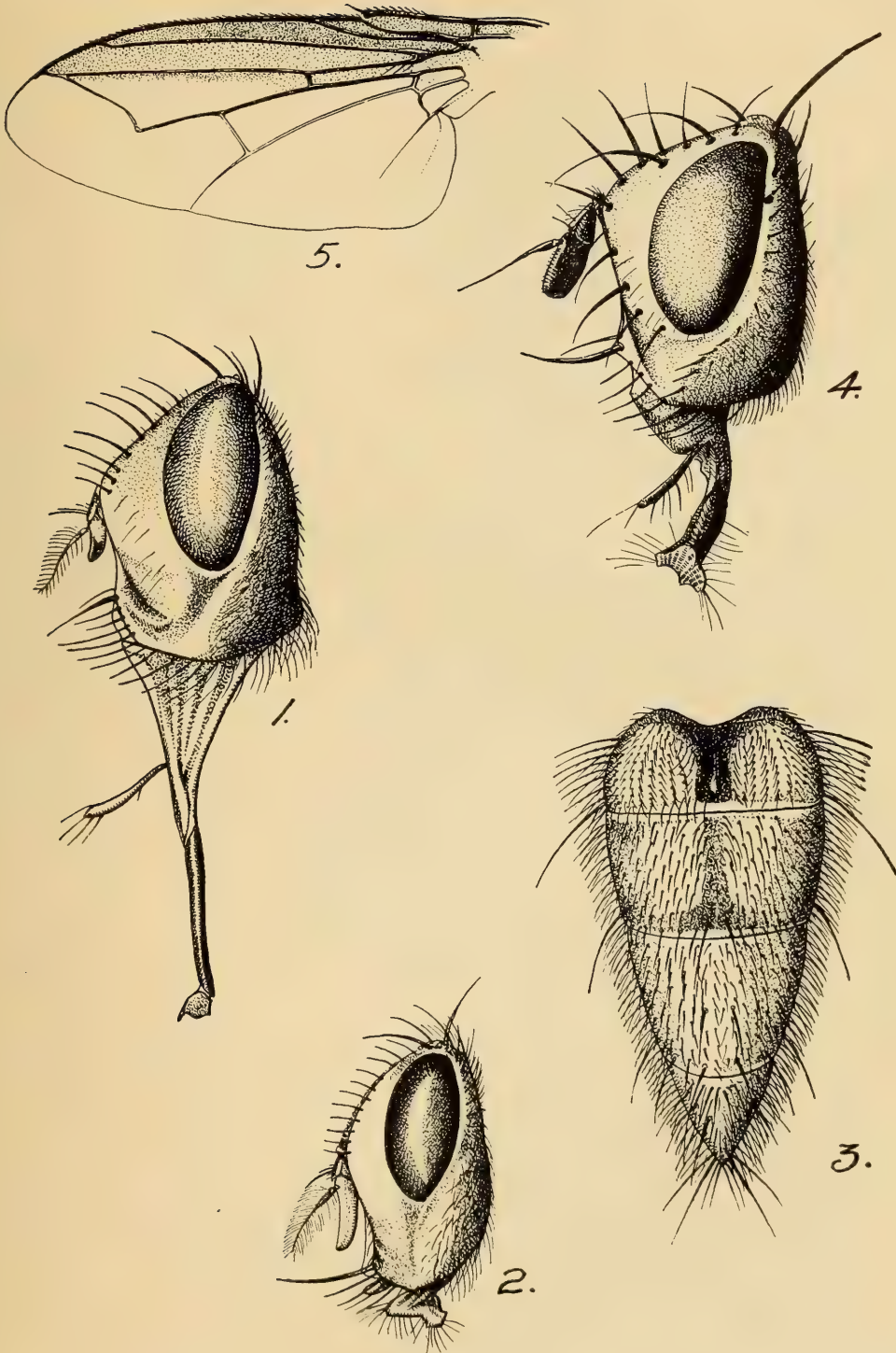
8. *Neodichocera tridens*, head, lateral view.

9. *Neodichocera tridens*, head, front view.

10. *Neodichocera tridens*, left middle tibia.

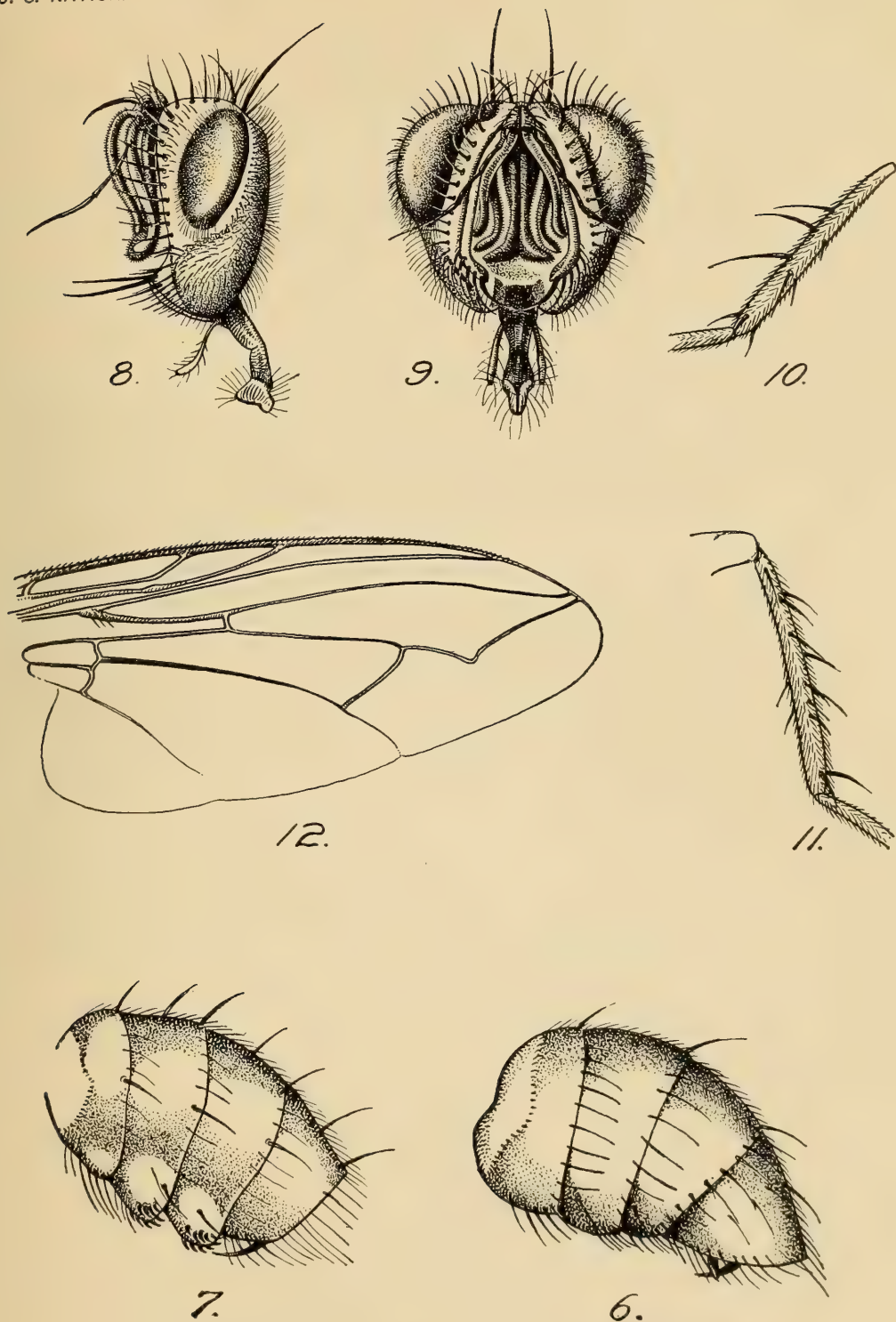
11. *Neodichocera tridens*, left hind tibia.

12. *Neodichocera tridens*, wing.



NEW DIPTERA FROM NORTHEASTERN MEXICO.

FOR EXPLANATION OF PLATE SEE PAGE 186.



NEW DIPTERA FROM NORTHEASTERN MEXICO.

FOR EXPLANATION OF PLATE SEE PAGE 186.

DESCRIPTIONS OF A NEW GENUS AND SPECIES OF THE DISCODRILID WORMS.

By MAURICE C. HALL,

Assistant Zoologist, United States Bureau of Animal Industry.

Some worms collected on crayfish in the creeks of the Great Basin near Salt Lake City, Utah, by Mr. George Haley, were sent in to the zoological division of this bureau in December, 1913, and were found by the writer to be discodrilids. A comparison with the forms given in Pierantoni's (1912) valuable monograph and with the new species added by Ellis (1912) showed that the Utah specimens constitute a new genus and species. The writer is indebted to Prof. J. Percy Moore, of the University of Pennsylvania, for assistance in connection with the literature dealing with this group of annelids.

According to Pierantoni (1912) the discodrilids constitute a quite homogeneous group of modified oligochaetes, ranging in size from 1 mm. to 12 mm. long, with a maximum width, when in a state of moderate distension, not to exceed one-tenth of the body length. According to Pierantoni the maximum width is attained in the posterior third of the body, the ends always being narrower, but Ellis (1912) lists *Cambarincola philadelphica* as having the head as wide as or wider than the greatest body width.

There is a distinct oval or cylindrical cephalic region, with a more or less profound median sulcus. The mouth is surrounded by a fleshy ring, sometimes divided into two or more equal or unequal lobes which may be prolonged into digitiform or tentaculiform appendages. Inside of the mouth, at the base of this fleshy ring or sucker is a circlet of numerous minute papillae. The median sulcus is at the base of the circumoral sucker. The cephalic region is divisible into 3 segments, the præstomium and 2 succeeding segments, the third very small. The first extends to the median sulcus. The division is based on the structure of the nervous and circulatory systems in this region.

The trunk region always consists of 11 segments, of which 8 are quite distinct, the last 3 being small and rather indistinct. The last segment is prolonged into a terminal sucker. The 8 prominent anterior segments are constantly divided into 2 unequal parts by a sulcus toward the posterior fourth of the segment. The region immediately following the cephalic is somewhat narrower than the cephalic in all species. The fifth, sixth, and seventh segments are

frequently somewhat swollen and in mature specimens the sixth and seventh form a clitellum. Paired or unpaired nephridial apertures occur in segments 3 and 9 of the trunk. The spermatheca opens in the mid-ventral line in segment 5; the male sexual aperture is similarly located in segment 6. The female sex apertures, paired, open on the sides of the posterior portion of segment 7. The anus is in the mid-dorsal line of segment 10.

The body cavity is divided by 7 dissepiments, forming the trunk segments 1 to 8.

The digestive cavity runs in a comparatively straight line from the mouth to the anus which is on the dorsum just in front of the sucker. The buccal region is provided with a powerful musculature and armed internally with a pair of solid chitinous dental plates, one dorsal and the other ventral, the dorsal being usually a little the larger. When these plates are of different form there is a hiatus in one to fit a tooth in the other. A muscular pharynx in the cephalic segments is followed by a short esophagus in the first trunk segments, passing without distinct demarcation into the intestine which terminates in an anus with a muscular sphincter.

The nervous system consists of a pair of supraesophageal ganglia in the head region. Circumesophageal commissures from these unite ventrally to form 3 pairs of simple or bilobed ganglia and 3 large pairs of lateral nerve trunks, which indicate the tripartite segmentation of the head. Following this there is a chain of 8 ganglia, usually double or bilobed, which becomes in the last 3 trunk segments a ganglionic mass, corresponding, as its nerves show, to 3 pairs of bilobed ganglia.

The circulatory system consists of a dorsal and a ventral vessel, connected anteriorly by 4 pairs of transverse trunks and posteriorly by 1 pair. From the third to the eighth trunk segment the dorsal vessel forms the pulsatile heart. The ventral vessel divides posteriorly into two branches which pass up around the intestine and unite to join the posterior limit of the dorsal vessel.

The excretory system consists of 2 pairs of nephridia. The anterior pair has its ciliated apertures in the second trunk segment and opens externally by lateral pores or a single dorsal pore just behind the dissepiment separating segments 2 and 3. These nephridia are not bilaterally symmetrical. The anterior tubule may extend from the third into the first segment and the posterior from the third into the fourth. The second pair of nephridia are symmetrical and are in the eighth trunk segment with the nephridiopore opening externally just behind the dissepiment separating segments 8 and 9.

The discodrilids are always hermaphroditic, the genital organs being in the fifth, sixth, and seventh segments. The male organs consist of a pair of testes in the anterior part of the fifth segment, with sometimes another pair in the anterior part of the sixth, the

male sexual products being liberated in the body cavity in these segments. There are 2 or 4 spermaducts, according to the number of testes, located in the dissepiments between segments 5 and 6 in the first case and also in that between 6 and 7 in the second case. The spermaducts open into a single atrium after each pair has united to form a deferent vessel. The atrium always consists of an enlarged distal portion and a narrower portion which forms a short bursa. Within the bursa is the penis, usually eversible, though *Cambarincola macrodonta* is listed as not having an eversible penis. The two ovaries are paired on the dissepiments between trunk segments 6 and 7, and project into segment 7. Frequently 2 or 3 large eggs in an advanced stage of maturation may be found in this segment. The organ for the emission of these eggs consists of 2 funnel-like ciliated pores in the latero-ventral wall near the posterior limit of the seventh trunk segment.

As a complement of the genital system, there is always in the fifth trunk segment an unpaired spermatheca, opening in the middle of the segment in the mid-ventral line. This is of variable form, globular, flask-shaped, cylindrical, or more or less elongate-bifid, extending into the following segment. The blind end is usually free, but may be contracted against the dorsal wall by means of a peritoneal investment. Odier (1823) described the copulation of two individuals.

The discodrilids live on crayfish. They are not parasitic when young, a study of the intestinal tract at this period showing vegetable detritus and small animals. In the adult stage the teeth are used to break the skin of the host animal in order to suck the blood. I have found several pieces of striated, voluntary muscle fiber in the intestine of the adult discodrilid described in this paper.

According to Pierantoni (1912) discodrilids are recorded from Europe, North America, oriental Asia, and Japan. Moquin-Tandon (1846) lists 2 species, *Branchiobdella chilensis* and *Br. auriculæ*, from Santiago de Chile, South America, designating them as not well-known species.

The features of systematic importance are the external form, preoral lobe, structure of the dental plates and of the genitalia.

According to Prof. J. Percy Moore (in correspondence) the name Discodrilidae dates from Vejdovsky (1884) which is not available to me. While this name has the family termination, it is merely a group name, as there is no genus from which the name Discodrilidæ could be derived. This name should be suppressed in favor of the family name Branchiobdellidae. In the available literature I find Branchiobdellidae first used by Ludwig (1886), but it probably antedates that. As these annelids make up a very distinct group, quite unlike other annelids, I have proposed here the following classification.

Superfamily BRANCHIOBDELLOIDEA Hall, 1914.

Superfamily diagnosis.—Annulata: Modified oligochaetes with the characteristics given in the foregoing part of the paper.

Type and only family.—Branchiobdellidae.

Family BRANCHIOBDELLIDAE.

Family diagnosis.—Branchiobdelloidea: With the characters of the superfamily.

Type genus.—*Branchiobdella* Odier, 1823.

The following key to the genera of Branchiobdellidae is based in part on Pierantoni's (1912) paper and partly on Ellis's (1912) paper:

1. Trunk region provided with dorsal or ventral appendages..... 2
 Trunk region smooth, not provided with such appendages..... 4
2. Trunk region bearing appendages on dorsal side..... 3
 Trunk region bearing appendages on ventral side..... *Cirrodrilus*.
3. Head not provided with tentaculiform appendages..... *Pterodrilus*.
 Head provided with tentaculiform appendages..... *Ceratodrilus*.
4. With 1 pair of testes..... *Branchiobdella*.
 With 2 pair of testes..... 5
5. Prostomium plurilobate, with or without digitiform appendages... *Stephanodrilus*.
 Prostomium entire or divided into a dorsal and ventral lobe..... 6
6. Spermatheca bifid, dental plates colorless, penis eversible, pair of large clear glands in each of 9 post-cephalic segments..... *Bdellodrilus*.
 Spermatheca not bifid, dental plates colored, penis not eversible, no large clear glands in the 9 post-cephalic segments..... *Cambarincola*.

Key to the North American species of Branchiobdellidae.

Branchiobdella Odier, 1823.

- Prostomium entire, dental plates dissimilar, the dorsal with 5 and ventral with 4 teeth..... *B. americana*.
 Prostomium bilobed, dental plates with 2 lateral and 2 median teeth... *B. tetrodonta*.

Bdellodrilus Moore, 1895.

1. Dental plates dissimilar..... *Bd. illuminatus*.
 Dental plates similar..... 2
2. Prostomium entire..... *Bd. instabilis*.
 Prostomium bilobed..... *Bd. pulcherrimus*.

Pterodrilus Moore, 1895.

- Dorsal appendages on segments 3, 4, 5, and 8..... *Pt. alvicornus*.
 Dorsal appendages on segments 2 to 8, inclusive..... *Pt. distichus*.

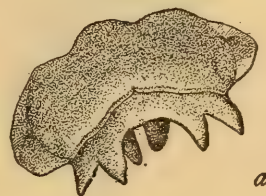
Cambarincola Ellis, 1912.

- Head as wide as or wider than greatest body width, campanulate; 1 lip, slightly crenate; dorsal plate with 7 teeth, ventral with 10..... *C. philadelphia*.
 Head not as wide as greatest body width, tapering anteriorly; 2 lips; dorsal plate with 5 teeth, ventral with 4..... *C. macrodonta*.

CERATODRILUS, new genus, 1914.

Generic diagnosis—*Branchiobdellidae*.—Prostomium bilobed, not sharply so, each lobe fringed with 4 or 5 papillæ on lips. Dental plates brown, of a roughly crescentic outline, slightly dissimilar, the ventral with 6 teeth, the dorsal with 7, the teeth being of comparatively uniform size (fig. 1). The antero-dorsal border of the head is furnished with a membranous border deeply incised to form 4 tentaculiform appendages (figs. 2 and 3). The first 7 trunk segments are furnished with dorsal appendages extending from the lateral border in a pointed band, the number of points usually 6, but on some segments 7 or 8. Spermatheca cylindrical to flask shaped, not bifid. Penis eversible. Testes in segments 5 and 6.

Type-species.—*Ceratodrilus thysanosomus*, new species.



CERATODRILUS THYSANOSOMUS, new species, 1914.

Specific diagnosis—*Ceratodrilus*.—Length, 2 to 2.8 mm. Maximum head diameter, 400 μ ; maximum body diameter, 660 μ ; maximum sucker diameter, 360 μ . Maximum length of cirriform appendages of head, about 180 μ .

The material sent in by Mr. Haley was in a poor state of preservation, as was a second consignment which he very kindly furnished. I have, therefore, only undertaken a study of the worm sufficient to fix it generically and specifically. An examination of the anterior pair of nephridia shows that the more anterior nephridium extends through the first and second segments, and that the posterior nephridium extends through the second, third, and fourth segments, but I am unable to say from the material in my possession whether these nephridia have a common opening or separate openings. The rest of the anatomy seems to conform to the general type.

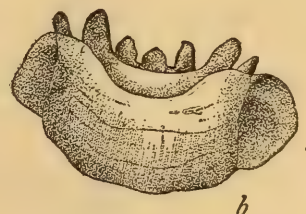
Host.—"Crayfish."

Location.—The collector, Mr. Haley, writes: "They were particularly abundant among the egg masses of the female and those infested seemed to weaken and die."

Locality.—Streams of Great Basin, Salt Lake City, Utah.

Type-specimens.—Cat. No. 17708 U.S.N.M. (Bureau of Animal Industry Helminthological Collection).

The American species of *Branchiobdellidae* have been reported from the following localities and hosts:



$\frac{1}{20}$ mm.

FIG. 1.—CERATODRILUS THYSANOSOMUS. DENTAL PLATES. a, VENTRAL PLATE; b, DORSAL PLATE.

Branchiobdella americana from *Cambarus viridis*, *C. latimanus*, *C. hayi* (Texas); *C. rusticus*, *C. immunis*, and *Cambarus* sp. (Raleigh, North Carolina).

Branchiobdella tetrodonta from *Astacus klamathensis* (Klamath River, California).

Bdellodrilus illuminatus from *Cambarus bartonii* and "crayfish" (Lake Clear, New York).



FIG. 2.—*CERATODRILUS THYSANOSOMUS*.
VENTRAL VIEW.

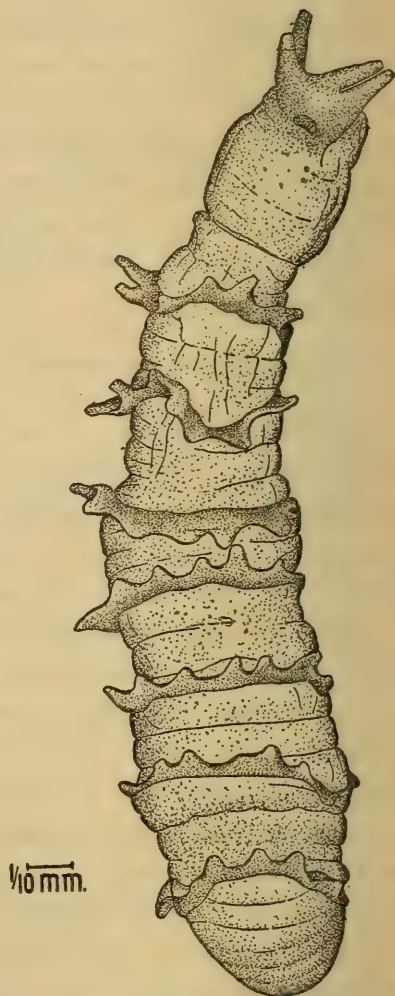


FIG. 3.—*CERATODRILUS THYSANOSOMUS*.
DORSAL VIEW.

Bdellodrilus pulcherrimus from *Cambarus bartonii* (Watauga County, North Carolina); "crayfish" (Lake Clear, New York).

Bdellodrilus instabilis from *Cambarus bartonii* (Philadelphia, Pennsylvania; Watauga County, North Carolina); "crayfish" (Lake Clear, New York).

Cambarincola philadelphica from *Cambarus bartonii* (Philadelphia, Pennsylvania; Watauga County, North Carolina).

Cambarincola macrodonta from *Cambarus diogenes* (Boulder, Colorado).

Ceratodrilus thysanosomus from "crayfish" (Salt Lake City, Utah).
Pterodrilus alcicornus from *Cambarus acuminatus* (Watauga County, North Carolina).

Pterodrilus distichus from *Cambarus bartonii* (western New York).

Moore (1895:454) mentions *Bdelloodrilus manus*, new species, from *Cambarus bartonii* in western New York, but did not describe the species at the time or subsequently.

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NEW GENERA AND SPECIES OF GALL MIDGES.

By E. PORTER FELT,

State Entomologist of New York.

The following descriptions of new genera and species are based upon a collection of gall midges in the United States National Museum, kindly loaned for study by Mr. F. Knab, through the courtesy of Dr. L. O. Howard. The forms are so interesting from both a taxonomic and faunal standpoint that it has been deemed best to characterize them in the hopes that others may give attention to this practically unworked field.

It will be noted that an unusually large percentage of these insects are referable to the Asphondyliariae, an exceptionally interesting group because of its high degree of specialization and wide distribution. A table for the separation of the genera of the world, a modification of that given by Dr. J. J. Kieffer in fascicle 152, Genera Insectorum, has been prepared not only for the purpose of facilitating the recognition of these new forms, but also to give a taxonomic summary of the tribe. It will be noticed that there are two distinct lines of specialization, the dominant having a protractile aciculate ovipositor, usually accompanied by a uni or bidentate terminal clasp segment in the male. The more generalized in this group is the widely distributed *Schizomyia* recorded from five of the six continents and presumably occurring also in Australia. The more easily recognized and apparently very successful *Asphondylia* has been recorded from all continents, there probably being a considerable number of species in each.

The less highly specialized *Asphondyliariae* have a wide distribution and apparently a much greater restriction in the number of species. The American *Cincticornia* has a near relative in the European *Polystepha*, both being closely restricted to oak, while the food plant of the very distinct though similar *Eocincticornia* of Australia is unknown.

The distribution of the various genera in the Asphondyliariae is also interesting as indicating the original home of the group, the thoroughness of distribution and subsequent specialization after dissemination became impossible. The following list shows 18 genera, 10 of which occur in the Tropical Americas, namely, Southern North America, Central America, Northern South America, and the West Indies, South America alone being credited with 7 genera. It is this region which is the home of the synthetic *Feltomyia*, a genus presenting the antennal characters of *Schizomyia*, while the ovipositor and terminal clasp segment of the male show an affinity with *Cincticornia*. A somewhat similar combination obtains in the Brazilian *Proasphondylia* with the pectinate terminal clasp segment of *Cincticornia* and a subaciculate ovipositor, suggesting a relationship with *Asphondylia*. Africa has 5 genera, Europe, Asia, and North America 4 each, while Australia is credited with but 2. Relatively the faunae of Europe and North America have been much more carefully explored than those of Africa, Asia, South America, and in particular, Australia. Systematic collecting in the Tropical and Subtropical sections of the globe would give rich returns in this group.

The following is a tabulation of the geographical distribution of the various genera:

Family ASPHONDYLIARIAE.

Distribution of the genera.

Schizomyia, Europe, Northern Africa, East Indies, West Indies, North and South America.

Kiefferia, Europe.

Tetrasphondylia, Mozambique.

Parasphondylia, East Africa.

Xenasphondylia, West Indies.

Asphondylia, Europe, Asia, Africa, North and South America, Australia.

Bruggmanniella, Brazil.

Proasphondylia, Brazil.

Bruggmannia, Brazil.

Oxasphondylia, Guatemala.

Houardiella, Northern Africa.

Zalepidota, Brazil.

Polystepha, Europe.

Cincticornia, North America.

Feltomyia, Mexico and West Indies.

Eocincticornia, Australia.

Daphnephila, Bengal.

Ozobia, Brazil.

Table for the separation of the genera.

- a*¹. Ovipositor protractile, aciculate or nearly so, the terminal clasp segment of the male usually uni or bidentate.
- b*¹. Palpi quadriarticulate.
- c*¹. Flagellate antennal segments with long whorled hairs and 2 strongly sinuous and anastomosing circumfili, especially in the male.
- d*¹. Ovipositor aciculate, without lamellæ apically; larval breastbone bidentate.
Schizomyia Kieffer.
- d*². Ovipositor subaciculate, with 2 very small lamellæ apically; larval breastbone unidentate.....*Kiefferia* Mik.
- c*². Flagellate antennal segments with short hairs, not whorled.
- d*¹. Flagellate antennal segments sessile, without an appreciable stem.
- e*¹. Claws much longer than the pulvilli, the basal segment of the ovipositor with rows of minute spinules.....*Tetrasphondylia* Kieffer.
- e*². Claws as long as the pulvilli, the first segment of the ovipositor finely striate, without spinules.....*Parasphondylia* Kieffer.
- d*². Flagellate antennal segments subsessile, with a stem about one-fourth the length of the basal enlargement; claws shorter than the pulvilli.
Xenasphondylia, new genus.
- b*². Palpi bi or triarticulate, rarely uniarticulate.
- c*¹. Circumfili in the female consisting of two comparatively simple bands.
- d*¹. Terminal clasp segment of the male uni or bidentate, not pectinate.
- e*¹. Subcostal cell normal, not opaque, the ovipositor with a lobed pouch proximally, not vesiculate basally.....*Asphondylia* H. Loew.
(Syn. *Monasphondylia* Kieffer.)
- e*². Subcostal cell opaque, the ovipositor with a globose, striate basal enlargement.....*Bruggmanniella* Tavares.
- d*². Terminal clasp segment of the male pectinate.
- e*¹. Terminal clasp segment apical; ovipositor subaciculate, with submedian groups of hairs on the distal segment.....*Proasphondylia*, new genus.
- e*². Terminal clasp segment of the male subapical, the ovipositor probably as in *Schizomyia*.....*Bruggmannia* Tavares.
- c*². Circumfili in the female forming 5 irregular, anastomosing bands; ovipositor as in *Asphondylia*.....*Oxasphondylia*, new genus.
- b*³. Palpi uniarticulate.
- c*¹. Terminal clasp segment of the male subapical, conical....*Houardiella* Kieffer.
- c*². Terminal clasp segment of the male bidentate, the subcostal cell remarkably broad, a rudimentary vein spur at the base of subcosta.
Zalepidota Rübsaamen.
- a*². Ovipositor exerted, apically with lobes or triangular plates; terminal clasp segment of the male usually serrate apically.
- b*¹. Palpi quadriarticulate.
- c*¹. Terminal clasp segment of the male subapical; third and fourth antennal segments not fused, the circumfili coarsely reticulate in the male, the pulvilli longer than the claws.....*Polystepha* Kieffer.
- c*². Terminal clasp segment of the male apical; third and fourth antennal segments fused, the circumfili usually with many fine reticulations in the male, the pulvilli usually shorter than the claws.....*Cincticornia* Felt.
- b*². Palpi triarticulate.
- c*¹. Terminal clasp segment of the male serrate apically.

- d*¹. Circumfili of male coarse, very irregular, 4 or 5 transverse fili to a segment, the plates of the ovipositor triangular.....*Feltomyia* Kieffer.¹
- d*². Circumfili of male fine, about 18 transverse fili to a segment, the terminal lobes of the ovipositor roundly quadrate.....*Eocincticornia*, new genus.
- c*². Terminal clasp segment of the male bidentate, subapical, the ovipositor conical.....*Daphnephila* Kieffer.
- b*³. Palpi uniarticulate, the flagellate antennal segments subsessile, the abdomen with caducous scales, the short ovipositor biarticulate.....*Ozobia* Tavares.

The drawings were all made with the aid of the camera lucida and are more or less diagrammatic. The types or cotypes of the new genera and species here described are in the United States National Museum.

MICROCERATA BUSCKI, new species.

This small midge was collected in September, 1901, by Mr. August Busck at Baracoa, Cuba. It is of interest largely because it shows the subtropical distribution of the genus.

Male.—Length, 1.2 mm. Antennae, as long as the head; 8 and possibly 9 segments, the second enlarged, globose, the fifth broadly pyriform, with a length one-fourth greater than its diameter, with a sparse subbasal whorl of long, stout setae and a scattering subapical whorl of short, stout spines. The eighth segment is slightly produced and more or less fused with the narrowly fusiform ninth. Palpi one-half longer than the antennae, the first and second segments subequal, each with a length over twice the diameter, the third one-half longer than the second, more slender, and the fourth about twice as long as the second, more slender. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum and abdomen dark brown, almost black. Genitalia fuscous. Wings hyaline, subcosta uniting with the margin near the basal half, the third vein at the distal fourth, the fourth vein forking just beyond the middle of the wing; the fifth joining the posterior margin at the distal fourth, the sixth at the basal half. Halteres and legs fuscous yellowish red, the pulvilli as long as the simple curved claws. Genitalia; basal clasp segment long, tapering; terminal clasp segment swollen basally, stout and about three-fourths the length of the basal clasp segment; dorsal plate moderately long, tapering to an obliquely rounded, thickly setose apex. Type Cecid. 1532.

Type.—Cat. No. 18485, U.S.N.M.

RUBSAAMENIA MULTINODA, new species.

The species described below was labeled Fort Pikit, Mindanao, May 31, 1907, C. H. Halliday, collector. It can be easily distinguished by the characters given below.

¹ Judging from larval characters, this genus is closely related to and may possibly be a synonym of *Uteella* Rübsaamen, a genus founded upon a larva.

Female.—Length, 1.5 mm. Antennae nearly as long as the body, rather thickly haired, yellowish; 23 segments, the first somewhat produced, with a length one-half greater than its diameter, the third with a length five times its diameter, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length twice its diameter and a rather thick subapical whorl of long, stout setae; low circumfili occur near the basal fourth and subapically; terminal segment evidently composed of three rather closely fused units and having a length at least four times its diameter and showing a distinct constriction near the basal third, a less evident one just beyond the middle and terminating in a short, stout, finger-like process. Palpi; first segment subquadrate, with a length twice its diameter, the second one-half longer than the first, the third nearly twice the length of the second, and the fourth one-third longer than the third, the segments successively more slender. Mesonotum reddish brown, the submedian lines yellowish. Scutellum whitish, postscutellum and abdomen brownish yellow, the latter thickly haired. Ovipositor nearly as long as the body, slender, recurved dorsally. Wings hyaline, the fifth and sixth veins simple. Halteres yellowish white. Coxae yellowish. Legs dark straw, the distal tarsal segments somewhat lighter, the pulvilli nearly as long as the strongly curved unidentate claws. The terminal lobes of the ovipositor indistinctly triarticulate, the two basal subquadrate, each with a length a little greater than its diameter, the terminal lobe narrowly oval, all sparsely setose. Type Cecid. 1531.

Type.—Cat. No. 18486, U.S.N.M.

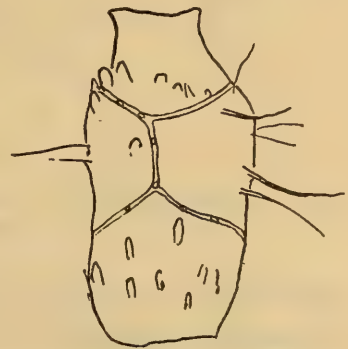


FIG. 1.—DIAGRAM OF FIFTH ANTENNAL SEGMENT, FEMALE, RUBSAAMENIA MULTINODA.

CTENODACTYLOMYIA, new genus.

The remarkable midge described below is referable to the Dasyneurariæ and runs in our keys to *Rhizomyia*, from which it is easily distinguished by the larger number of antennal segments and in particular by the pectinate claws. It is a highly specialized form, as evidenced by the very long, narrow wings and the rudimentary condition of the anterior branch of the fifth vein.

Type of the genus.—*Ctenodactylomyia watsoni*, new species.

CTENODACTYLOMYIA WATSONI, new species.

A number of midges were reared from nipped, blistered leaf galls on *Coccolobis floridana*, collected by Mr. C. J. Cragin, at Palm Beach, Fla., March 18, 1914, and submitted for study by Prof. J. R. Watson,

of the Agricultural Experiment Station. The galls are abundant and irregularly clustered upon the small piece of leaf accompanying the specimens. The insects evidently transform within the galls, since whitish exuviae are to be found projecting from the deformations.

Gall.—Diameter, 3 mm., circular, blisterlike, dark green, with a slight, darker, median nipple. The gall shows about equally upon both sides of the leaf.

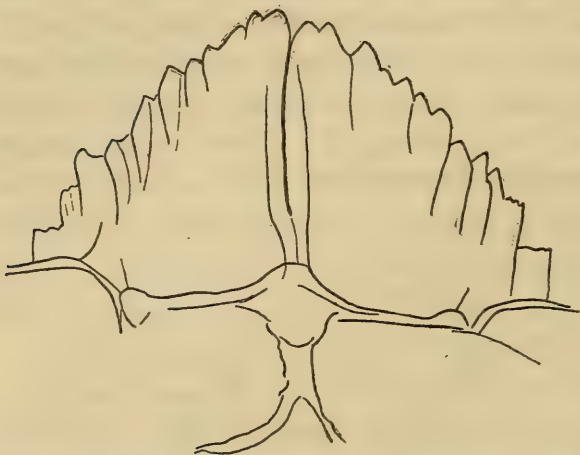


FIG. 2.—CEPHALIC HORNS OF PUPA OF CTENODACTYLOMYIA WATSONI.

Larva.—Length, 3 mm., yellowish, the segmentation distinct and tapering toward the posterior extremity. Head and breastbone indistinct in the one specimen before us.

Exuviae.—Length, 3 mm., whitish transparent. Antennal cases extending nearly to the base of the abdomen, wing pads to the third abdominal segment, and the leg cases about to the sixth abdominal segment; cephalic horns large,

chitinous, approximate, the lateral margins strongly serrate and tapering irregularly to the median line, the abdominal segments each with a transverse row of about 8 chitinous spines near the anterior third, the number being reduced to about 4 on the penultimate segment; terminal segment bilobed.

Pupa.—Length, 3 mm., moderately stout and variably yellowish or dark brown, dependent upon the development, the external structures as in the exuviae.

Female.—Length, 3 mm. Eyes confluent. Antennae nearly as long as the body, sparsely haired, light brown; 14 segments, the third and fourth fused, the fifth with a stem about one-fifth the length of the subcylindric basal enlargement, which latter has a length three and one-half times its diameter and sparse subbasal and subapical whorls of moderately stout setae; circumfili near the basal third and apically; terminal segment produced, apically with a finger-like process about one-third the length of the cylindric basal enlargement, which latter has a length three times its diameter. Palpi; first segment with a length over twice its diameter, the second as long as the first, somewhat stouter, the third more than twice the length of the second, slender; mouth parts slightly produced, with a length about one-fourth the diameter of the head. Mesonotum



FIG. 3.—MIDDLE CLAW OF MALE OF CTENODACTYLOMYIA WATSONI.

dark reddish brown, the submedian lines and median area a slaty gray. Scutellum pale orange apically, grayish basally; postscutellum dark brown. Abdomen dark brown, sparsely short haired. Wings very narrow, with a length fully three times the width; subcosta uniting with costa at the basal third, the cross vein indistinct, the third vein joining the posterior margin well beyond the apex of the wing, the fifth vein forked, the rudimentary anterior branch uniting with the margin near the distal third, the well-developed posterior branch at the basal third. Halteres yellowish white, the club slightly fuscous. Coxae dark brown, reddish brown apically, the anterior femora and tibiae mostly dark brown, the former yellowish white basally, the latter narrowly annulate with white basally; tarsi a dark grayish brown, the distal three segments mostly yellowish gray, the posterior femora

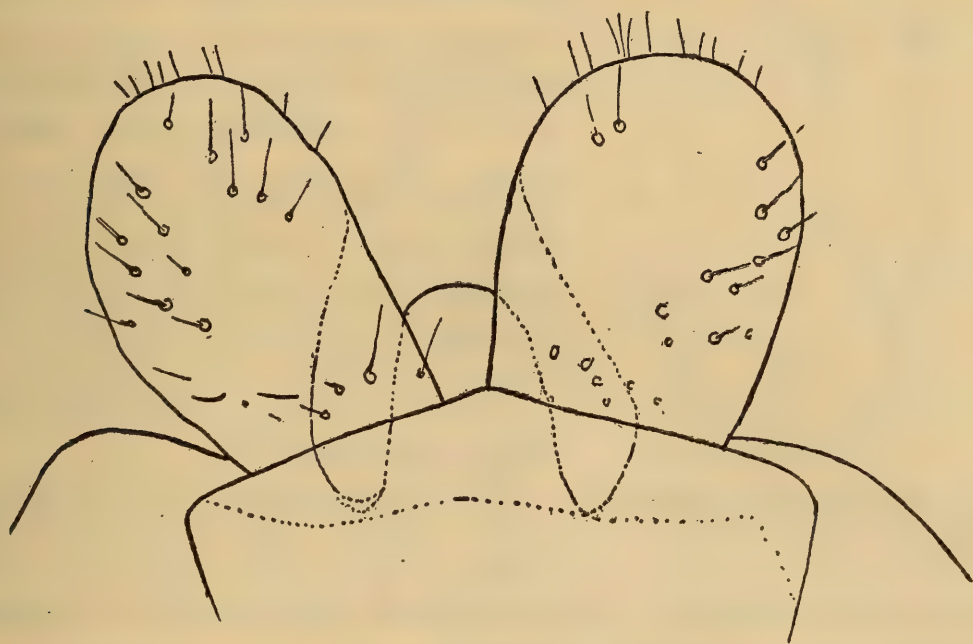


FIG. 4.—DORSAL VIEW OF THE APEX OF THE FEMALE ABDOMEN OF CTENODACTYLOMYIA WATSONI.

with the basal half yellowish white, and the entire tarsi mostly yellowish gray, otherwise as in the anterior tarsi; claws moderately long, stout, distinctly angulate basally, with three relatively large and two minor pectin; pulvilli rudimentary. Ovipositor short, the lobes roundly rectangular and thickly setose, minor lobe tapering to a narrowly rounded apex.

Male.—Length, 3 mm. Antennae probably extending to the second abdominal segment, the fifth with a stem about one-fourth the length of the cylindric basal enlargement, which latter has a length thrice its diameter and rather thick subbasal and subapical whorls of stout, nearly straight setae; terminal segment with a finger-like appendage nearly one-half the length of the cylindric basal enlargement, which latter has a length thrice its diameter; claws slender, slightly curved and with about five well-developed and two

minor pectin. The claws are more slender and the pectin more numerous than in the female. Genitalia; basal clasp segment long, stout; terminal clasp segment as long as the basal, rather stout, somewhat irregular and with a well-developed though inconspicuous tooth apically; dorsal plate short, deeply and roundly emarginate, the lobes well separated and tapering to a narrowly rounded, thickly and coarsely setose apex; ventral plate long, broad, broadly and slightly emarginate, the lateral angles rather thickly and coarsely setose; style rather long, stout, narrowly rounded. Other characters as in the female. Type Cecid. a 2504.

Paratype.—Cat. No. 19006, U.S.N.M.

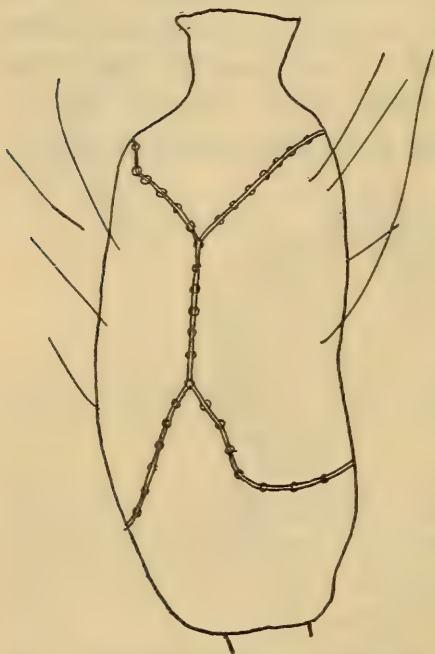


FIG. 5.—OUTLINE OF FIFTH ANTENNAL SEGMENT, FEMALE, OF *XENASPHONDYLIA ALBIPES*.

XENASPHONDYLIA, new genus.

Antennal segments 14, subsessile, the stem with a length about one-fourth that of the cylindric basal enlargement. The palpi are long, quadriarticulate, the claws simple, stout, and about equal in length to the pulvilli. Ovipositor as long as the body, the basal portion fleshy, eversible, the distal part aciculate as in *Asphondylia*.

Type of the genus.—*Xenasphondylia albipes*, new species.

This genus approaches *Tetrasphondylia* Kieffer and *Parasphondylia* Kieffer, from which it may be separated by the distinctly more generalized condition of the antennæ and the more specialized ovipositor.

XENASPHONDYLIA ALBIPES, new species.

Female.—Length, 2.75 mm. Antennae extending to the fifth abdominal segment, sparsely haired, basally yellowish, the flagellate segments yellowish brown; 14 segments, the third and fourth free, the fifth with a stem one-fourth the length of the basal enlargement, which latter has a length $3\frac{1}{2}$ times its diameter, with short, sparse subbasal and subapical whorls of setae and numerous finer ones. Low circumfili united on one face occur near the basal fourth and subapically; terminal segment with a narrowly conical apical process having a length about one-half that of the cylindric basal enlargement, which latter has a length three times its diameter. Palpi long, the first segment irregular, the second with a length nearly three times its diameter, the third fully one-half longer than the second, more slender and the fourth three-fourths longer than the

third, capitate. Eyes black, coarsely granulate. Mesonotum shining dark brown, the submedian lines and posterior median area sparsely haired and fuscous yellowish. Scutellum whitish, post-scutellum yellowish orange. Abdomen rather thickly haired, dark reddish brown, the ovipositor fuscous orange. Wings hyaline, costa dark brown, the third vein uniting with the margin well beyond the apex, the fifth at the distal fourth, its branch near the basal half. Halteres yellowish transparent. Coxae and femora basally yellowish brown, the distal portion of femora, tibiae and the most of tarsi dark reddish brown, the distal tarsal segments, in some instances, portions of the fourth also, silvery white or yellowish white. Claws stout, strongly curved, simple, the pulvilli longer than the claws. Ovipositor longer than the body, the distal part aciculate as in *Asphondylia*. Type Cecid. 1525, C. 1528.

This beautiful species was collected by August Busck in the San Francisco Mountains, Santo Domingo, West Indies, September, 1905.

Type.—Cat. No. 18487, U.S.N.M.

PROASPHONDYLIA, new genus.

Antennal segments 14, subsessile, the distal segment not reduced (presumably not in the female); the circumfili much as in *Schizomyia*. The palpi are triarticulate. The ovipositor relatively short, the distal portion being subaciculate. The male genitalia with the terminal clasp segment subapical, short, stout, pectinate apically.

Type of the genus.—*Proasphondylia brasiliensis*, new species.

This genus approaches *Parasphondylia* Kieffer, from which it is easily separated by the triarticulate palpi and is closely related to *Feltomyia* Kieffer, though it is quite different from the latter, especially in the development of the ovipositor. We have in this genus an approach to the characters found in the American *Cincticornia*. It is a peculiar synthetic type.

PROASPHONDYLIA BRASILIENSIS, new species.

Male.—Length, 1.2 mm. Antennæ nearly as long as the body, sparsely haired, light brown; 14 subsessile segments, the third and fourth narrowly fused, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length $2\frac{1}{2}$ times its diameter and is provided with rather high, irregular circumfili, much as in *Schizomyia*; terminal segment slightly reduced, with a length three times its diameter and tapering gradually to a narrowly rounded apex. Palpi; first segment short, irregular, the second with a length about three times its diameter, the third nearly three times the length of the second, dilated. Mesonotum reddish brown, the submedian lines whitish. Scutellum fuscous yellowish, the postscutellum and abdomen yellowish brown. Wings hyaline;

the third vein uniting with the margin at the apex; the fifth forked. Halteres fuscous yellowish, the knob whitish. Coxae fuscous yellowish, the legs a nearly uniform yellowish white. Claws slender, evenly curved, simple, the pulvilli rudimentary. Genitalia; basal clasp segment short, stout; terminal clasp segment subapical, short, tapering to a rather narrow, coarsely pectinate, chitinized apex. Other structures indistinct.

Female.—Length, 1.5 mm. Antennae nearly as long as the body, sparsely haired, light brown; 14 subsessile segments, the third and fourth narrowly fused, the fifth with a short stem and a cylindric basal enlargement, which latter has a length $3\frac{1}{2}$ times its diameter

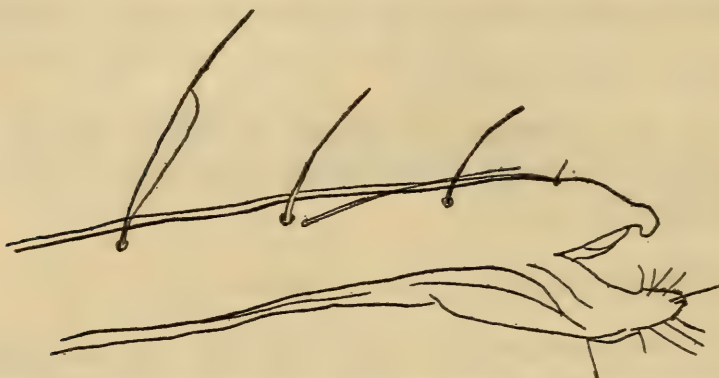


FIG. 6.—OUTLINE OF THE TIP OF THE OVIPOSITOR OF PROASPHONDYLIA BRAZILIENSIS.

and rather high, irregular circumfili as in the female of *Schizomyia*; the thirteenth segment with a length nearly four times its diameter, the fourteenth probably only slightly reduced. Palpi; first segment* irregular,

the second with a length nearly twice its diameter, the third greatly produced, with a length nearly three times the second, the mouth parts slightly produced. Ovipositor with a length less than half the abdomen, the basal portion stout, fleshy, the distal part subaciculate, with about four submedian groups of one or two hairs at nearly regular intervals, and apically tapering slightly to an irregular point. Other characters nearly as in the male.

Exuviae.—Length, 2 mm., light yellowish brown, the dorsum of the abdominal segments with a transverse row of moderately stout, chitinous points at the anterior third. Type Cecid. 1526.

The above specimens were loaned for study through the courtesy of the United States National Museum and are labeled 121 Bonito, Province of Pernambuco, Brazil, Jan. 29, 1883.

Type.—Cat. No. 18488, U.S.N.M.

OXASPHONDYLIA, new genus.

This form is closely related to *Asphondylia*, though easily distinguished therefrom in the female by the relatively slight reduction of the terminal antennal segments and the reticulate circumfili. The dorsal pouch so characteristic of *Asphondylia* is only slightly developed in this species.

Type of the genus.—*Oxasphondylia reticulata*, new species.

OXASPHONDYLIA RETICULATA, new species.

The midge described below was labeled June 27, Cacao, Trece Aguas, Alta V. Paz., Guatemala, Schwarz and Barber collection. Only the female is known.

Female.—Length, 2.5 mm. Antennæ extending to the third abdominal segment, thickly haired, brownish yellow; 14 segments, the

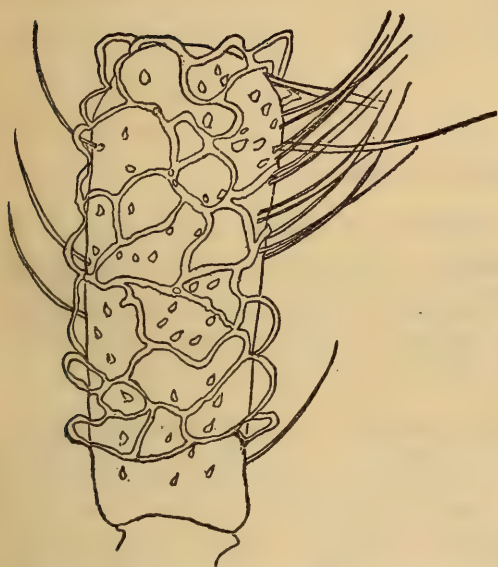


FIG. 7.—FIFTH ANTENNAL SEGMENT, FEMALE, OF OXASPHONDYLIA RETICULATA.



FIG. 8.—OUTLINE OF THIRTEENTH AND FOURTEENTH ANTENNAL SEGMENTS OF FEMALE OF OXASPHONDYLIA RETICULATA.

first broadly conical, with a length only one-fourth greater than its diameter, the second subhemispherical, the third and fourth free,



FIG. 9.—OUTLINE OF THE BIARTICULATE PALPUS OF OXASPHONDYLIA RETICULATA.

the fifth with a length three times its diameter, uniformly and rather thickly clothed with narrow, curved scales, and with a series of sinuous reticulate circumfili approximating the condition found in the male of *Schizomyia*, there being approximately five sinuous transverse circumfili on each segment; the three distal segments somewhat reduced; the twelfth with a length $2\frac{1}{2}$ times its diameter; the thirteenth with a length twice its diameter, and the fourteenth with a length one-fourth greater than its diameter, apically tapering abruptly to a conical apex. Palpi short, the first segment subquadrate, with a length one-fourth greater than its diameter, the second subfusiform,

reduced, about as long as the first. Mesonotum yellowish brown, the submedian lines sparsely haired. Scutellum yellowish transparent, postscutellum a little darker. Abdomen reddish brown, the genitalia yellowish red. Wings subhyaline, being rather thickly clothed with short, curved scales, the third vein uniting with the margin at the apex of the wing. Halteres reddish brown. Coxae brownish yellow. Legs mostly thickly clothed with fuscous scales, the distal tarsal segments on the anterior legs somewhat lighter. Claws heavy, strongly curved, simple, the pulvilli rudimentary. Ovipositor when extended nearly as long as the body, the dorsal lobes divided, subquadrate, and only sparsely haired, the basal portion of the ovipositor fleshy, eversible, the distal part aciculate as in *Asphondylia*. Type Cecid. 1534.

Type.—Cat. No. 18489, U.S.N.M.

ASPONDYLIA ALTANI, new species.

The midge is labeled San Marcos, Nicaragua, Baker collection. It is an interesting form in that it presents a comparatively generalized condition of the antennae, the basal, flagellate segments not being so greatly prolonged as in many of the typical species referable to this genus.

Female.—Length, 3 mm. Antennae nearly as long as the body, sparsely haired, dark brown; 10 and probably 14 segments, the fifth cylindric, with a length about four times its diameter, the basal circumfilum broadly sinuous and united with the nearly transverse apical filum by two longitudinal fili; terminal segments wanting. Palpi; first and second segments short, the second narrowly oval, with a length over twice its diameter, the third more than twice as long as the second, slender, basally capitate. Mesonotum grayish brown. Scutellum reddish brown, postscutellum yellowish brown. Abdomen a dark reddish brown. Wings hyaline, the third vein uniting with the margin at the apex of the wing. Halteres yellowish basally, whitish apically. Coxae and legs a nearly uniform yellowish brown, the pulvilli nearly as long as the relatively slender, strongly curved claws. Ovipositor when extended nearly as long as the body. Type Cecid. 1533.

Type.—Cat. No. 18490, U.S.N.M.

EOCINCTICORNIA, new genus.

Antennal segments 14, cylindric, sessile, the distal ones not plainly reduced and bearing in both sexes, low, finely reticulate circumfili. Palpi triarticulate. Wings with the third vein heavy, uniting with the margin just beyond the apex of the wing, the fifth vein, obsolescent distally, the anterior branch practically obsolete. Male genitalia with the basal clasp segment greatly produced, the terminal

subapical and shorter than the portion of the basal clasp segment extending beyond the point of insertion. Ovipositor short, fleshy, the lobes quadriarticulate, setose.

Type of the genus.—*Eocincticornia australasiae*, new species.

The circumfli indicate an affinity with the American *Cincticornia* and European *Polystepha*, though the reduction of the palpi, the greatly developed circumfli and basal clasp segment prevent its association with either of these genera.

EOCINCTICORNIA AUSTRALASIAE, new species.

The peculiar form described below was received through the courtesy of the United States National Museum and labeled Perth, West Australia, G. Compere, collector, 798. It is such a striking species that there should be no difficulty in recognizing it from the following characterization.

Male.—Length, 2 mm. Antennae nearly as long as the body, naked, dark brown; 14 sessile, cylindric segments, the first short, obconic, the second disk-like, the third and fourth free, the fifth with a length about $2\frac{1}{2}$ times its diameter, with a basal whorl of very short setæ and the entire surface covered with a fine reticulation of low, stout circumfli, there being about 18 very irregular transverse fili on a segment; terminal

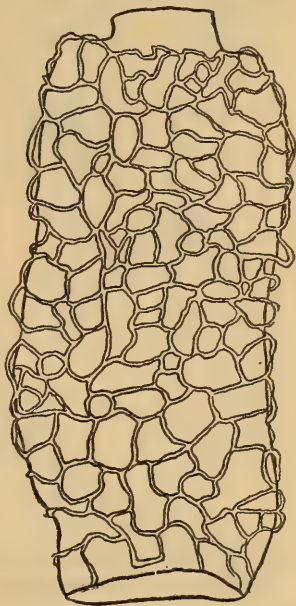


FIG. 10.—SIXTH ANTENNAL SEGMENT OF MALE OF *EOCINCTICORNIA AUSTRALASIAE*, SHOWING THE NUMEROUS ANASTOMOSING CIRCUMFLI. DIAGRAMMATIC.

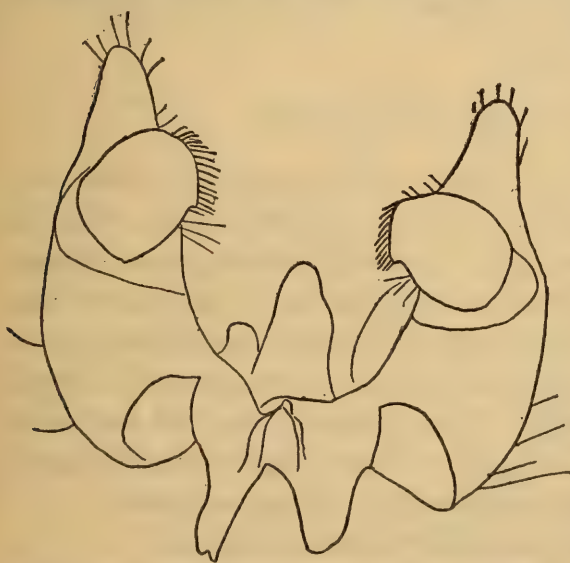


FIG. 11.—OUTLINE OF MALE GENITALIA OF *EOCINCTICORNIA AUSTRALASIAE*.

segment not reduced, with a length three times its diameter, obtuse apically. Palpi; first segment short, irregular, the second with a length about $2\frac{1}{2}$ times its diameter, stout, the third nearly three times the length of the second, irregular, slender. Mesonotum dark reddish brown. Scutellum and postscutellum dark yellowish brown. Abdomen very dark brown, almost black. Wings hyaline, the membrane almost free from hairs, subcosta uniting with costa at the basal third, the third vein heavy, joining the margin just beyond the wing apex, the fifth vein obsolescent distally, strongly curved and joining the posterior margin at the basal third; the anterior branch discernible only as an almost imperceptible line. Halteres fuscous yellowish. Coxae dark yellowish brown. Legs

mostly yellowish brown. Claws moderately heavy, strongly curved, simple, the pulvilli as long as the claws. Genitalia; basal clasp segment stout, long and produced to form a conspicuous roundly triangular apical process; terminal clasp segment subapical, short, stout, with a length less than the appendage of the basal clasp segment and the transverse apex with a heavy, chitinous pectination; dorsal plate broad, deeply and triangularly emarginate, the lobes tapering to a narrowly rounded apex; ventral plate short, broad, tapering to a broad, round emargination. Harpes short, stout, irregularly rounded apically; style longer, stout, obtuse.



FIG. 12.—SIDE VIEW OF THE APEX OF THE FEMALE ABDOMEN OF *EOCINCTICORNIA AUSTRALASIAE*.

Female.—Length, 2.75 mm. Antennae nearly as long as the body, dark brown; 14 segments, the fifth with a length $3\frac{1}{2}$ times its diameter and with somewhat coarser reticulate circumfili, there being approximately 12 irregular, transverse fili to a segment; the terminal segment with a length three times its diameter, the apex

narrowly rounded. Mesonotum dark brown, almost black. Scutellum dark yellowish brown, postscutellum fuscous. Abdomen dark yellowish brown. Halteres yellowish brown. Coxae dark brown. Ovipositor short; terminal lobes fleshy, roundly quadrate and thickly setose. Other characters practically as in the male. Type Cecid. 1538.

Type.—Cat. No. 18491, U.S.N.M.

EOHORMOMYIA, new genus.

The quadriarticulate palpi, the simple fifth vein and claws, the latter with well-developed pulvilli, indicate a relationship with the Formosan *Calodiplosis* Kieffer, though it is easily distinguished therefrom by the great reduction rather than production of the palpal segments and the less specialized wings and the cross-vein wanting or at most rudimentary. The third vein unites with the margin well beyond the apex of the wing. The male of this African form will doubtless approach, in certain characters, those given for *Calodiplosis*, though it is hardly possible that they can be referred to the same genus.

Type of the genus.—*Eohormomyia howardi*, new species.

EOHORMOMYIA HOWARDI, new species.

The large, strikingly marked female described below was collected by Mr. C. W. Howard and labeled: "Along river, Umbelusi, 5-3-09, Lorenzo Marquez." The striking characteristics of this insect should render its identification comparatively easy.

Female.—Length, 6 mm. Antennae nearly as long as the body, thickly haired, light brown;(?) 14 segments, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length fully four times its diameter and with a slight constriction near the basal third. There is a sparse subbasal whorl of moderately stout setae and a thicker subapical whorl. Low circumfili, slightly looped, occur near the basal half and apically on the enlargement. Palpi; the first segment subglobose, the second a little smaller, globose, the third short, irregular, with a length twice its diameter, the fourth three-fourths the length of the third, ovate. Mesonotum yellowish brown, the submedian lines sparsely haired. Scutellum and postscutellum concolorous. Abdomen thickly haired, a rich dark brown, the ovipositor yellowish. Wings subhyaline, the membrane rather thickly clothed with fuscous hairs; costa dark brown, the third vein uniting with the margin well beyond the apex, the fifth simple, strongly curved near the middle of the wing and joining the posterior margin at the distal third. Halteres yellowish basally, dark brown apically. Coxae yellowish brown; femora, tibiae, and tarsi dark yellowish brown and rather thickly clothed with fuscous hairs, the distal tarsal segments somewhat lighter; the pulvilli as long as the stout, evenly curved, simple claws. Ovipositor short, yellowish, the lobes tapering to a narrowly rounded setose apex, minor lobes triangular, with a narrowly rounded apex. Type Cecid. 1523.



FIG. 13.—FIFTH ANTENNAL SEGMENT OF THE FEMALE OF *EOHORMOMYIA* HOWARDI.



FIG. 14.—DORSAL VIEW OF THE APEX OF THE FEMALE ABDOMEN OF *EOHORMOMYIA* HOWARDI.

Ovipositor short, yellowish, the lobes tapering to a narrowly rounded setose apex, minor lobes triangular, with a narrowly rounded apex. Type Cecid. 1523.

Type.—Cat. No. 18492, U.S.N.M.

SCOPODIPLOSIS, new genus.

This form is allied to the African *Compsodiplosis* Tavares, from which it is most easily separated by the spotted wings, the nearly

free third and fourth antennal segments, and the character of the ovipositor.

The generic type is *Scopodiplosis speciosa*, new species.

SCOPODIPLOSIS SPECIOSA, new species.

This striking species was labeled S. Bernardino, Paraguay, K. Fiebrig, collector. The abdomen was packed with eggs, the number being estimated at 300.

Female.—Length, 4 mm. Antennae as long as the body, thickly haired, brownish yellow; 14 segments, the fifth with a stem one-half the length of the cylindric basal enlargement, which latter has a length four times its diameter and a distinct constriction near the basal fourth; low circumfili occur at the basal and distal portions of the indistinctly separated apical part of the enlargement; terminal segment with a tapering finger-like process one-half the length of the subcylindric basal enlargement, which latter has a distinct subbasal constriction and a length five times its diameter. Palpi; the first segment irregular subquadrate, the second stout, with a length about three times its diameter, swollen near the basal third and truncate apically. Eyes holoptic, dark brown. Mesonotum honey yellow, an irregular median dark brown line with a marked expansion anteriorly and two irregular dark brown sublateral areas. Scutellum and postscutellum yellowish white. Abdo-



FIG. 15.—SIDE VIEW OF THE APEX OF THE ABDOMEN OF *SCOPODIPLOSIS SPECIOSA*, FEMALE.

men whitish yellow, sparsely clothed with white hairs. Wings yellow, distinctly spotted, there being an irregular, broken, transverse, fuscous band near the distal third and a somewhat linear fuscous area on the branch of the fifth vein expanding and extending along the posterior margin toward the anal angle. There is also an indistinct fuscous area near the base of the wing and occupying most of the anal angle; costa mostly honey yellow, except the somewhat fuscous basal fourth; subcosta uniting with the margin near the basal half, a supernumerary vein extending from near the normal point of union with the cross vein to the basal fourth of subcosta. This may be a simple dilation and partial division of subcosta or a rudiment of the cross vein; the third vein unites with the margin well behind the apex, the fifth at the distal fourth, its branch near the basal half. Coxae and femora basally yellowish, the distal portion of femora,

most of tibiae and the tarsi a golden yellow or yellowish, except for a rather distinct fuscous band near the middle of femora, narrow apical fuscous bands on tibiae, and on the second and third tarsal segments; claws slender, evenly curved, simple, the pulvilli rudimentary. Ovipositor short, the terminal portion of the body triangular and bearing apically two slightly chitinized, upcurved dorsal plates and a triangular ventral plate. Type Cecid. 1524.

Type.—Cat. No. 18493, U.S.N.M.

REPORT ON THE HOLOTHURIANS COLLECTED BY THE
UNITED STATES FISHERIES STEAMER "ALBATROSS"
IN THE NORTHWESTERN PACIFIC DURING THE SUM-
MER OF 1906.

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The collection of holothurians made by the United States Fisheries steamer *Albatross* during her cruise in the northwest Pacific Ocean in the summer of 1906 was exceedingly rich. Its study was originally assigned by the United States Bureau of Fisheries to the late Prof. K. Mitsukuri, but after his death in September, 1909, was transferred to the writer. The material was found to be all but untouched by the late professor, only two species of *Molpadia* having been worked out, one of which, *Ankyroderma diomedæ*, was described in his posthumous work, *Studies on Actinopodous Holothurioidea*.

The specimens contained in nearly 200 bottles and vials are referable to 95 species and 1 subspecies, belonging to 37 genera. The following 3 could not, however, be specifically determined owing to the imperfectness of the specimens or to their young state:

Pælopatides (?), sp.
Cucumaria, sp. (juv.).

Anapta (?), sp.

The following 46 are new to science:

Synallactes multivesiculatus.
S. gilberti.
Bathyplores östergreni.
Mesothuria media.
Pseudostichopus aleutianus.
Ps. molpadioides.
Ps. arenosus.
Ps. nudus.
Ps. unguiculatus.
Capheira mollis.
Deima mosaicum.
Orphnurgus rigidus.
Pannychia moseleyi virgulifera.
Ilyodæmon miurense.
Peniagone japonica.
Achlyonice monactinica.
Scotoplanes théeli.
Benthodytes gotoi.

Molpadia diomedæ (Mitsukuri).
M. clarki.
M. infesta.
Caudina ludwigi.
Cucumaria ijimai.
C. lamperti.
C. spinosa.
C. shuiteri.
C. constricta.
C. globosa.
Thyone punctata.
Th. parva.
Th. bicornis.
Th. imbricata.
Pseudocucumis dactylicus.
Ps. watasei.
Ps. sagamiensis.
Ps. tabulatus.

*Phyllophorus cylindricus.**Ph. glaucus.**Ph. diomedæ.**Ph. minutus.**Psolidium vitreum.**Ps. bullatum.**Protankyra kagoshimensis.**Tæniogyrus cidaridis.**Toxodora pacifica.**Myriotrochus mitsukurii.*

The following are reported for the first time from the northwest Pacific:

Mesothuria murrayi (Théel).*Orphnurgus insignis* Fisher.*Psychropotes raripes* Ludwig.*Euphronides depressa* Théel.*Benthodytes sanguinolenta* Théel.*Molpadia intermedia* (Ludwig).*M. musculus* Risso.*M. spinosa* (Ludwig).*Cucumaria mosaica* Kœhler and Vaney.*Psolus chitonoides* Clark.*Chiridota albatrossii* Edwards.

It may be worthy of note that the collection contains three new cases of brooding holothurians, all belonging to Cucumarids, namely, *Cucumaria iijimai*, *C. lamperti*, and *Thyone imbricata*. I may also mention another fact which appears to me to have some significance in connection with the breeding habit, namely, that in some holothurians, such as *Bathyplores tizardi*, ova are found attached about the mouth in the male.

It is also remarkable that in some deep-sea forms the ova are of quite large size, those of *Enypniastes eximia* measuring 3-3.5 mm. and those of *Benthodytes gotoi* and *Euphronides depressa* 2.5 mm. in diameter. They exceed the previous record given by Ludwig for *Benthodytes sanguinolenta* (2-2.2 mm.). Another fact of some interest occurs in some deep-sea forms. That the mesentery of the third limb of the intestine is attached to the body wall along the ventral edge of the right dorsal radial muscle has already been observed by Ludwig in *Benthodytes sanguinolenta*, and the same peculiarity also occurs in several others, such as *Deima mosaicum*, *Pannychia moseleyi virgulifera*, *Ilyodæmon iijimai*, *I. miurense*, *Achlyonice monactinica*, *Scotoplanes théeli*, *Psychropotes raripes*, *Benthodytes gotoi*. This peculiarity seems to be rather common among the Elaspoda.

To the United States Bureau of Fisheries I tender my thanks for permission to work on the valuable collection. I also extend my thanks to Prof. I. Ijima, who has kindly given me a table in his Institute, and to Prof. S. Goto for reading the manuscript and making suggestions. Further I wish to acknowledge my great indebtedness to Miss Mary J. Rathbun who has kindly read the proofs.

Table of stations where *Holothurians* were obtained—Continued.

Station No.	Date.	Locality.	Depth in fathoms.	Temperature.	Nature of bottom.	Species.
4795	June 20	Lat. 52° 46' 50" N.; long. 158° 44' 30" E.	69	°	Green sand, pebbles.	<i>Cucumaria glacialis</i> .
4798	June 21	Lat. 51° 37' N.; long. 156° 21' E.	25	36.9	Green sand.	<i>Myriotrochus rinkii</i> .
	Unknown	Milne Bay, Simushir Island, Kuriles.	Shore.			<i>Cucumaria vegae</i> .
4807	July 6	Mororan, Hokkaido.	44		Shells, coarse gravel.	<i>Cucumaria japonica</i> .
4808	July 16	Lat. 41° 36' 12" N.; long. 140° 36' E.	47		Sand, shells, coarse gravel.	(?) <i>Psolus japonicus</i> .
	July 18	Lat. 41° 35' 50" N.; long. 140° 36' 45" E.	176	34.9	Fine brown mud (?)	(?) <i>Psolus japonicus</i> .
4812	July 23	Lat. 38° 33' N.; long. 138° 40' E.	200	33.9	Brown mud, black sand.	(<i>Synallactes</i>) <i>nozawai</i> .
4832	July 24	Lat. 36° 14' 30" N.; long. 135° 56' 30" E.	76	53.2	Dark gray sand.	<i>Molpadia infesta</i> .
4875	Aug. 2	Tsuruga.	Shore.			<i>Synallactes nozawai</i> .
4880	Aug. 9	Lat. 34° 19' N.; long. 130° 09' E.	59		Fine gray sand, broken shells.	<i>Molpadia roretzii</i> .
4893	Aug. 9	Lat. 34° 16' N.; long. 130° 16' E.	59		do.	<i>Stichopus japonicus</i> .
4895	Aug. 9	Lat. 32° 27' N.; long. 128° 34' E.	181	50.2	Gray sand, broken shells, rock.	<i>Colochirus inornatus</i> .
	do.	Lat. 32° 32' N.; long. 128° 32' 50" E.	106	55.9	Gray sand, broken shells, pebbles.	<i>Cucumaria constricta</i> .
	do.	Lat. 32° 33' 10" N.; long. 128° 32' 10" E.	95		do.	<i>Cucumaria globosa</i> .
4900	Aug. 10	Lat. 32° 28' 50" N.; long. 128° 34' 40" E.	139	52.9	Gray sand, broken shells.	<i>Bathyplotes östergreni</i> .
4903	do.	Lat. 32° 31' 10" N.; long. 128° 33' 20" E.	139		do.	<i>Cucumaria selenkai</i> .
4904	do.	Lat. 32° 31' 20" N.; long. 128° 32' 40" E.	107		Fine gray sand, broken shells.	<i>Colochirus dolotum</i> .
4906	Aug. 11	Lat. 31° 39' N.; long. 129° 20' 30" E.	369			<i>Cucumaria capensis</i> .
4907	do.	Lat. 31° 39' 30" N.; long. 129° 24' E.	406	42.6	Gray Globigerina ooze.	<i>C. constricta</i> .
4913	Aug. 12	Lat. 31° 39' 10" N.; long. 129° 22' 30" E.	391		do.	<i>Psudocucumis tabulatus</i> .
4914	do.	Lat. 31° 33' N.; long. 129° 26' 30" E.	427		Gray Globigerina ooze, broken shells.	<i>Enyprinaetes eximia</i> .
4915	do.	Lat. 31° 31' N.; long. 129° 25' 30" E.	427		do.	<i>Sphærothuria bilentaculata</i> .
4919	Aug. 13	Lat. 30° 34' N.; long. 129° 19' 30" E.	440	41.8	Globigerina ooze.	<i>Enyprinaetes eximia</i> .
4935	Aug. 16	Lat. 30° 57' 20" N.; long. 130° 35' 10" E.	103	60.6	Stones.	(<i>Sphærothuria</i>) <i>bilentaculata</i> .
4936	do.	Lat. 30° 54' 40" N.; long. 130° 37' 30" E.	103		do.	<i>Psudocucumis dactylicus</i> .
4937	do.	Lat. 31° 13' N.; long. 130° 43' 10" E.	58	64.8	Mud, lava, pebbles.	<i>Enyprinaetes eximia</i> .
4940	Aug. 17	Lat. 31° 22' 10" N.; long. 130° 40' 10" E.	115	59.8	Brown mud, brown specks.	<i>Stichopus nigripunctatus</i> .
4941	do.	Lat. 31° 22' N.; long. 130° 39' 20" E.	117			<i>Stichopus nigripunctatus</i> .
4945	do.	Lat. 31° 38' 45" N.; long. 130° 45' E.	70	60.4	Green mud.	<i>Molpadia roretzii</i> .
						<i>Protankyra kagoshimensis</i> .

4946	Aug. 20	Lat. 31° 29' 10" N.; long. 130° 34' 30" E.	39	68.7	Brown sand, broken shells, pebbles.....	<i>Holothuria monacaria</i> .
4956	Aug. 23	Lat. 32° 32' N.; long. 132° 25' E.	720	37.5	{ Greenish brown mud, fine gray sand, Foraminifera.	<i>Detma mosaicum</i> . <i>Lætmogone parva</i> . <i>Orphnurgus insignis</i> . <i>O. rigidus</i> . <i>Lætmogone violacea</i> . <i>Orphnurgus insignis</i> . <i>O. rigidus</i> . <i>Lætmogone violacea</i> . <i>Bathyplores tizardi</i> . <i>Orphnurgus rigidus</i> . <i>Pseudostichopus unguiculatus</i> . <i>Orphnurgus insignis</i> . <i>Lætmogone violacea</i> . <i>Bathyplores tizardi</i> . <i>Pseudostichopus nudus</i> . <i>Mesothuria media</i> . <i>Pseudostichopus trachus</i> . <i>Ilgodæmon ijimai</i> . <i>Palopates appendiculata</i> . <i>Benthodytes sanguinolenta</i> . <i>Benthodytes sanguinolenta</i> . <i>Benthodytes sanguinolenta</i> . <i>Peniagone japonica</i> . <i>Achiyone monactinica</i> . <i>Synallactes gilberti</i> . <i>Psolidium vitreum</i> . <i>Synallactes nozawai</i> . <i>Pseudostichopus molpadioides</i> . <i>Synallactes nozawai</i> . <i>Molpadia clarki</i> . <i>Myriotrochus mitsukurii</i> . <i>Myriotrochus mitsukurii</i> . <i>Myriotrochus mitsukurii</i> . <i>Synallactes nozawai</i> . <i>Chiridota albatrossii</i> . <i>Synallactes nozawai</i> . <i>Phyllophorus diomedæz</i> . <i>Chiridota albatrossii</i> . <i>Cucumaria calcigera</i> . <i>Cucumaria calcigera</i> . <i>Cucumaria calcigera</i> . <i>Cucumaria calcigera</i> . <i>Cucumaria calcigera</i> . <i>Chiridota albatrossii</i> . <i>Chiridota albatrossii</i> . <i>Chiridota albatrossii</i> . <i>Cucumaria japonica</i> . <i>Pannychia moseleyi virgulifera</i> .
4957	...do....	Lat. 32° 36' N.; long. 132° 23' E.	437	39.8	do.....	
4958	...do....	Lat. 32° 36' 20" N.; long. 132° 24' 30" E.	405	40.1	do.....	
4959	...do....	Lat. 32° 36' 30" N.; long. 132° 23' 20" E.	405	.....	do.....	
4960	...do....	Lat. 32° 34' N.; long. 132° 41' 45" E.	578	38.7	do.....	
4966	Aug. 29	Lat. 33° 25' 20" N.; long. 135° 36' 20" E.	290	44.1	Brown mud, sand, Foraminifera.....	
4968	...do....	Lat. 33° 24' 50" N.; long. 135° 38' 40" E.	253	45.7	Dark gray sand, brown mud, broken shells	
4971	Aug. 30	Lat. 33° 23' 30" N.; long. 135° 34' E.	649	38.1	Brown green mud, Foraminifera.....	
4972	...do....	Lat. 33° 25' 45" N.; long. 135° 33' E.	440	39.8	do.....	
4973	...do....	Lat. 33° 24' 15" N.; long. 135° 30' 30" E.	600	38.2	Brown mud, stones.....	
4974	Aug. 31	Lat. 33° 18' 10" N.; long. 135° 40' 50" E.	905	36.6	Brownish green mud, Foraminifera.....	
4979	Sept. 1	Lat. 33° 53' N.; long. 137° 42' E.	943	36.4	Brown mud, fine sand, Foraminifera.....	
4982	Sept. 19	Lat. 43° N.; long. 140° 10' 30" E.	390	37.7	Green mud.....	
4983	...do....	Lat. 43° 01' 35" N.; long. 140° 10' 40" E.	428	32.7	do.....	
4984	...do....	Lat. 43° 04' 20" N.; long. 140° 12' 10" E.	248	33.0	do.....	
4985	...do....	Lat. 43° 05' 20" N.; long. 140° 15' 15" E.	224	33.1	Green mud (?).....	
4988	Sept. 20	Lat. 43° 23' 10" N.; long. 140° 21' 10" E.	68	45.0	Sand.....	
4993	Sept. 22	Lat. 45° 25' 30" N.; long. 140° 53' E.	142	35.1	Gray mud, sand, gravel.....	
4994	...do....	Lat. 45° 27' 50" N.; long. 140° 54' E.	190	34.0	Brown mud, fine black sand.....	
5000	Sept. 23	Lat. 47° 37' 30" N.; long. 141° 42' 30" E.	31	.....	Gray mud, green sand.....	
5001	...do....	Lat. 47° 35' N.; long. 141° 43' E.	30	.....	Green mud, gray sand.....	
5002	...do....	Lat. 47° 33' 30" N.; long. 141° 45' E.	30-35	.....	do.....	
5003	...do....	Lat. 47° 32' 30" N.; long. 141° 45' E.	35	42.4	Fine gray sand, green mud.....	
5004	...do....	Lat. 47° 31' N.; long. 141° 44' 30" E.	38	41.2	Green mud.....	
5006	Sept. 24	Lat. 46° 04' N.; long. 142° 29' E.	43	36.1	Green mud, fine gray sand.....	
5007	...do....	Lat. 46° 03' N.; long. 142° 31' E.	42	34.8	do.....	
5008	...do....	Lat. 46° 07' 50½ N.; long. 142° 37' 20" E.	40	33.9	do.....	
5009	...do....	Lat. 46° 24' 10" N.; long. 142° 40' E.	25	38.5	Green mud.....	
5010	...do....	Lat. 46° 30' 30" N.; long. 142° 43' 30" E.	21	(?)47.1	Green mud, sand.....	
5015	Sept. 26	Lat. 46° 44' N.; long. 144° 02' E.	510	35.9	Green mud.....	

Table of stations where *Holothurians* were obtained.—Continued.

Station No.	Date.	Locality.	Depth in fathoms.	Temperature.	Nature of bottom.	Species.
5017	Sept. 26	Lat. 46° 43' 30" N.; long. 143° 45' E.	64	.....	Brown mud, fine black sand, rock, coral.	<i>Psolus squamatus</i> .
5018	..do.....	Lat. 46° 41' 30" N.; long. 143° 57' 40" E.	100	30.4	Brown mud, black sand, pebbles.	<i>Chiridota albatrossii</i> .
5020	Sept. 27	Lat. 48° 32' 45" N.; long. 145° 07' 30" E. (approx.)	73	30.9	Green mud, sand, pebbles.	<i>Chiridota albatrossii</i> .
5021	..do.....	Lat. 48° 32' 30" N.; long. 145° 08' 45" E. (approx.)	73	30.9	.....do.....	<i>Phylloporus cylindricus</i> .
5022	..do.....	Lat. 48° 35' 30" N.; long. 145° 20' E. (approx.)	109	30.1	Green mud, coarse black sand.	<i>Chiridota albatrossii</i> .
5023	..do.....	Lat. 48° 43' 30" N.; long. 145° 03' E.	75	30.9	Sand, pebbles.	<i>Thyone imbricata</i> .
5026	Sept. 28	Lat. 48° 36' 10" N.; long. 145° 17' 30" E.	119	30.4	Green mud, black sand, gravel.	<i>Chiridota albatrossii</i> .
5029	..do.....	Lat. 48° 22' 30" N.; long. 145° 43' 30" E.	440	35.3	Black sand, gravel.	<i>Synallactes nozawai</i> . <i>Bathyploetes moseleyi</i> . <i>Pelopotides</i> (?), sp. <i>virgulifera</i> . <i>Pannychia moseleyi virgulifera</i> . <i>Chiridota albatrossii</i> .
5030	Sept. 29	Lat. 46° 29' 30" N.; long. 145° 46' E.	1,800	35.4	Brown mud.	<i>Pelopotides</i> (?), sp. <i>Psychropotes taripies</i> . <i>Benthodites gotoi</i> . <i>Molpadia musculus</i> . <i>Pannychia moseleyi virgulifera</i> .
5032	Sept. 30	Lat. 44° 05' N.; long. 145° 30' E.	300	34.9	Brown mud, fine black sand, gravel.	<i>Scotoplanes theeli</i> . <i>Psolus squamatus</i> . <i>Chiridota albatrossii</i> .
5033	..do.....	Lat. 44° 04' 20" N.; long. 145° 28' E.	533	35.9	Green mud, fine black sand.	<i>Pannychia moseleyi virgulifera</i> . <i>Scotoplanes theeli</i> . <i>Psolus squamatus</i> .
5036	Oct. 2	Lat. 41° 58' N.; long. 142° 30' 30" E.	464	37.9	Brown mud.	<i>Synallactes multivesiculatus</i> . <i>Chiridota albatrossii</i> .
5039	Oct. 3	Lat. 42° 11' N.; long. 141° 57' E.	326	37.9	Green mud.	<i>Pannychia moseleyi virgulifera</i> . <i>Molpadia intermedia</i> .
5043	..do.....	Lat. 42° 10' 20" N.; long. 142° 15' 20" E. (approx.)	330	37.9	Brown mud, fine black sand, coral, sand.	<i>Cucumaria spinosa</i> . <i>Chiridota albatrossii</i> .
5044	..do.....	Lat. 42° 10' 40" N.; long. 142° 14' E. (approx.)	309	32.1	Gray sand, coral, sand.	<i>Chiridota albatrossii</i> .
5045	..do.....	Lat. 42° 11' 10" N.; long. 142° 12' E. (approx.)	339	38.0	Brown mud, fine black sand, coral, sand.	<i>Chiridota albatrossii</i> .
5046	Oct. 10	Lat. 38° 15' 07" N.; long. 141° 44' 20" E.	82	50.8	Dark gray sand, pebbles.	<i>Synallactes ishikawai</i> . <i>Sichopus nigripunctatus</i> .
5046 or 5047	..do.....	Lat. 38° 12' 50" N.; long. 141° 49' 15" E.	107	49.6	Dark gray sand, broken shells, pebbles.	<i>Synallactes multivesiculatus</i> . <i>Cucumaria spinosa</i> . <i>Thyone parva</i> .
5048	..do.....	Lat. 38° 09' 24" N.; long. 141° 52' 30" E.	129	40.7	Dark gray sand, broken shells.	<i>Phylloporus diomedea</i> .
5051	..do.....	Lat. 38° 11' N.; long. 142° 12' E.	399	38.1	Dark gray sand, broken shells, Foraminifera.	<i>Synallactes ishikawai</i> . <i>Synallactes multivesiculatus</i> .

5053	Oct. 12	Lat. 34° 49' 20" N.; long. 138° 40' 15" E.....	503	34.9	Green mud.....	{ <i>Palopatides appendiculata</i> . <i>Cucumaria spinosa</i> . <i>Sphærothuria bitentaculata</i> . <i>Pseudostichopus trachus</i> . <i>Molpadia roretzii</i> . <i>Sphærothuria bitentaculata</i> . <i>Thyone multipes</i> . <i>Molpadia spinosa</i> . <i>Sphærothuria bitentaculata</i> . <i>Thyone multipes</i> . <i>Molpadia roretzii</i> . <i>Pseudostichopus trachus</i> . <i>Molpadia roretzii</i> . <i>Molpadia roretzii</i> . <i>Pseudocucumis watasei</i> . <i>Amplicyclus japonsicus</i> . <i>Bathyploes mosleyi</i> . <i>Molpadia diomedea</i> . <i>Torodora pacifica</i> . <i>Molpadia antarctica</i> . <i>Cucumaria mosata</i> . <i>Thyone bicornis</i> . (?) <i>Cucumaria sluteri</i> . <i>Anapta</i> (?), sp. <i>Orphnurgus rigidus</i> . <i>Lazmogone violacea</i> . <i>Pseudostichopus unguiculatus</i> . (?) <i>Peniagone japonica</i> . <i>Cucumaria sluteri</i> . <i>Synallactes gilberti</i> . <i>Pseudostichopus unguiculatus</i> . <i>Deima mosaicum</i> . <i>Peniagone japonica</i> . <i>Achlyonice monactinica</i> . <i>Euphronides depressa</i> . <i>Psolidium vircum</i> . <i>Pannychia mosleyi</i> . <i>Caudina ludwigii</i> . <i>Cucumaria</i> , sp. (juv.). <i>Psolidium vircum</i> . <i>Lazmogone violacea</i> . <i>Hyodæmon tjtmai</i> . <i>Sphærothuria bitentaculata</i> . <i>Pseudocucumis sagamiensis</i> . <i>Hyodæmon tjtmai</i> . <i>Synallactes ishikawai</i> . <i>S. discoidalis</i> . <i>Bathyploes mosleyi</i> .
5054	...do.....	Lat. 34° 52' 45" N.; long. 138° 42' 20" E.....	282	45.3	Green mud, broken shells, Foraminifera.	
5055	...do.....	Lat. 34° 53' N.; long. 138° 44' 15" E.....	124	56.6	Green mud, gray sand, broken shells, pebbles.	
5057	...do.....	Lat. 34° 58' 40" N.; long. 138° 34' E.....	270	44.8	Gray mud.....	
5059	Oct. 13	Lat. 35° 05' 30" N.; long. 138° 39' 50" E.....	297	45.0	Gray sand.....	
5060	...do.....	Lat. 35° 06' N.; long. 138° 40' 10" E.....	197	50.6	Coarse black sand.....	
5067	Oct. 15	Lat. 35° 05' 50" N.; long. 138° 41' 15" E.....	293	45.0	Brown sand, broken shells.....	
5069	...do.....	Lat. 35° 03' 10" N.; long. 138° 47' E.....	131	55.8	Mud, sand, broken shells.....	
5072	Oct. 16	Lat. 34° 44' 55" N.; long. 138° 22' 20" E.....	284	44.1	Gray mud.....	
5073	...do.....	Lat. 34° 46' N.; long. 138° 21' 50" E.....	148	54.6	....do.....	
5074	...do.....	Lat. 34° 40' 45" N.; long. 138° 18' 30" E.....	47	74.9	....do.....	
5079	Oct. 19	Lat. 34° 15' N.; long. 138° E.....	475	39.1	Pebbles.....	
5080	...do.....	Lat. 34° 10' 30" N.; long. 138° 40' E.....	505	38.7	Fine gray sand, Globigerina.....	
5082	Oct. 20	Lat. 34° 05' N.; long. 137° 59' E.....	662	37.7	Green mud, fine sand, Globigerina.....	
5083	...do.....	Lat. 34° 04' 20" N.; long. 137° 57' 30" E.....	624	38.1	Fine gray sand, Globigerina.....	
5082 or 5083						
5084	...do.....	Lat. 34° N.; long. 137° 49' 40" E.....	918	36.8	Green mud, fine sand, Globigerina.....	
5085	Oct. 23	Lat. 35° 06' 45" N.; long. 139° 19' 45" E.....	622	37.8	Green mud, fine black sand.....	
5087	...do.....	Lat. 35° 09' 40" N.; long. 139° 19' 05" E.....	614	37.5	Green mud.....	
5088	Oct. 25	Lat. 35° 11' 25" N.; long. 139° 28' 20" E.....	369	41.8	....do.....	
5090	Oct. 26	Lat. 35° 03' 50" N.; long. 139° 37' 30" E.....	200	47.6	Pebbles, black sand.....	
5091	...do.....	Lat. 35° 04' 10" N.; long. 139° 38' 12" E.....	197	47.6	Green mud, coarse black sand, pebbles...	

Table of stations where *Holothurians* were obtained—Continued.

Station No.	Date.	Locality.	Depth in fathoms.	Temperature.	Nature of bottom.	Species.
5092	Oct. 26...	Lat. 35° 04' 50" N.; long. 139° 38' 18" E.....	70	° 56.3	Coarse black sand.....	<i>Synallactes ishikawai</i> . <i>Bathyplores moseleyi</i> . <i>Mesothuria parva</i> . <i>Pseudostichopus trachus</i> . <i>Ilyodæmon ijimai</i> . <i>Stichopus nigripunctatus</i> . <i>Molpadia roreizi</i> .
5093	...do.....	Lat. 35° 03' 15" N.; long. 139° 37' 42" E.....	302	43.9	.....do.....	<i>Bathyplores moseleyi</i> . <i>Pseudostichopus trachus</i> . <i>Sphærothuria bilaculata</i> . <i>Synallactes ishikawai</i> . <i>Bathyplores moseleyi</i> . <i>Mesothuria parva</i> .
5094	...do.....	Lat. 35° 04' 42" N.; long. 139° 38' 20" E.....	88	54.8	Black sand, broken shells.....	<i>Pseudostichopus trachus</i> . <i>Ilyodæmon niurensis</i> . <i>Stichopus nigripunctatus</i> . <i>Thyone multipes</i> .

Family SYNALLACTIDÆ Ludwig.

Genus SYNALLACTES Ludwig.

1. SYNALLACTES DISCOIDALIS Mitsukuri.

Synallactes discoidalis MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 18-21, text-fig. 3.

Station 5091. Four specimens.

Habitat.—Various stations in Sagami Sea (Mitsukuri, 1912); south of Joga Shima, Sagami Sea.

2. SYNALLACTES ISHIKAWAI Mitsukuri.

Synallactes ishiikawai MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 21-23, text-fig. 4.

Station 5046. One specimen.

Station 5048. Four specimens.

Station 5091. Sixteen specimens.

Station 5092. Twenty-two specimens.

Station 5094. One specimen.

Habitat.—Sagami Bay (Mitsukuri, 1912); off Ojika Peninsula; south of Joga Shima, Sagami Sea.

3. SYNALLACTES NOZAWAI Mitsukuri.

Synallactes nozawai MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 23-25, text-fig. 5.

Station 4788. Two specimens.

Station 4789. Four specimens.

Station 4790. One specimen.

Station 4791. Five specimens.

Station 4792. Ten specimens.

Station 4812. Three specimens.

Station 4813. Three specimens.

Station 4982. Twelve specimens.

Station 4983. Three specimens.

Station 4993. Seventeen specimens.

Station 4994. Eleven specimens.

Station 5029. One specimen.

The species established on a unique specimen is thus represented by 72 specimens in the collection. The largest individual is 290 mm. in length. Color deep violet on dorsum, light brown or whitish on ventrum, papillæ of a lighter color, tentacles yellowish-brown, twenty in number. Pedicels of ventrolateral ambulacra about 70 in each, forming a zigzag row; those of the odd ambulacrum in two zigzag rows, each consisting of about 60 pedicels. Papillæ of dorsum arranged in six rows, of which the median two consist of 30 papillæ each, and the remaining four of 25 each. Quadriradiate tablelike deposits are largest at base of papillæ and pedicels, attaining the

diameter of 430μ , while those scattered in ventrum and pedicels are smallest, the diameter reaching down to 50μ . Tentacles are strengthened by bent, cylindrical rods with several short knobs usually in pairs, and perforated with very minute holes at each end.

Except that the dorsal papillæ are arranged in very indistinct rows, *Synallactes challenger*i (Théel) agrees with the present species in every essential character.

Habitat.—Hokkaido (Mitsukuri, 1912); Bering Sea; north of Sado Island; west of Hokkaido; off Cape Terpyeniya, Sakhalin.

4. SYNALLACTES MULTIVESICULATUS, new species.

Plate 8, figs. 1a-c.

Station 5036. Three specimens.

Station 5046 or 5047. One specimen.

Station 5051. One specimen.

Body slightly flattened, more tapering posteriorly than anteriorly, 250 mm. long and 45 mm. broad. Mouth subventral, anus terminal. Color brown, some with yellowish, others with purplish tinge, ventrum but slightly lighter. Tentacles 20, of intense brown color tinged with red. Pedicels rather few but quite large, 10 mm. long and 5 mm. across at base. The odd ambulacrum has two zigzag rows of about 48 pedicels each; ventrolateral ambulacra each with a zigzag row of 38 pedicels. Papillæ are small, only 8 mm. long at most, having no wartlike base. They form six rows on dorsal side, each row consisting of about 45 papillæ. Tablelike deposits scattered in perisome are similar to those of *S. nozawai*, only differing in being almost exclusively of triradiate type (pl. 8, figs. 1a-c). They are largest near bases of papillæ, with arms attaining the length of 165μ , and smallest on ventrum, especially on pedicels, with arms measuring only 35μ . Besides the scattered small tables, a few delicate supporting rods are found in papillæ, and the end-plate is represented by a number of irregularly branched rods. Unlike the papillæ the pedicels contain numerous, very robust rods and a single end plate. Supporting rods of tentacles are similar to those of papillæ. Radial segments of calcareous ring have each a bifurcated, prolonged anterior process. Polian vesicles are of a deep purplish-black color, numbering up to 13. Even in a young specimen 30 mm. long there were found 9 vesicles. Stone-canal situated in dorsal mesentery. Genital tubes branched twice or thrice, forming 2 tufts. Respiratory trees 2, well developed.

Besides the difference in deposits noted above as obtaining between this species and *S. nozawai*, the relation of size and number between pedicels and papillæ is reversed in the two species. *S. chuni* Augustin (= *S. triradiata* Mitsukuri) has triradiate deposits, but the arms of the table are slender and slightly bent, while in the present species they are thick and straight. Moreover, the pedicels are smaller and

much clustered in that species. The presence of as many as 10 or more Polian vesicles is a character which distinguishes the new species from all the others.

Habitat.—South of Hokkaido; off Ojika Peninsula, Honshu.

Type.—Cat. No. 34143, U.S.N.M.

5. *SYNALLACTES GILBERTI*, new species.

Plate 8, figs. 2a, b.

Station 4979. Two specimens.

Station 5084. Three specimens.

Body 80 mm. long and 20 mm. broad. Mouth subventral, anus terminal or turned dorsad. Color light gray with slight greenish tinge. Skin smooth to the touch, with thick gelatinous subcutaneous tissue. Tentacles 20. Pedicels of the odd ambulacrum rather scattered, not exceeding 25 in number, arranged in a zigzag or double row. Each ventrolateral ambulacrum has numerous pedicels which form a zigzag row along the margin of sole. There are 4 rows of papillæ on dorsum, each papilla being situated on a conical wart. Papillæ of the outer rows are larger than those of the inner, the wart measuring 4 mm. across and the free filamentous part attaining a length of 7 mm. Each of these rows consists of 12–15 papillæ. Much smaller papillæ belonging to ventrolateral ambulacra form a marginal row along each side. Scattered among these are found appendages of another kind. These are what have been called “Saugfüsschen im engeren Sinne” (Ludwig), or “low whitish warts” (Théel), or “fungiform papillæ” (Mitsukuri). They measure 0.55–1.20 mm. in diameter. Cruciform table-like deposits are uniformly distributed in general perisome. The arms do not meet in one point, but diverge from the ends of a short rod, thus becoming bilaterally symmetrical (pl. 8, fig. 2a). Each arm is perforated with a small hole at the end. Spire is solid and high; the end is divided into 3 long processes which unite again at some distance from the apex and thus give rise to a slitlike hole (fig. 2b). The deposits of ventrum vary in diameter between 60 and 100 μ , with a mean of about 80 μ , and the spire 65–70 μ high. Those of dorsum are 100 μ in diameter, ranging 77–140 μ , spire 100 μ high. Walls of pedicels and papillæ are beset with similar deposits, and a few curved rods are found near tips of pedicels. End-plate is well developed in pedicels but represented by irregularly branched rods in papillæ. The fungiform papillæ are destitute of tables but a branched body represents the end-plate. Supporting rods of tentacles are spinous and arcuate, often armed with some irregular branches. Calcareous ring consists of 10 weakly calcified segments. Polian vesicle single; stone-canal minute, with scattered, irregular latticed deposits in its wall. Genital tubes few in number, branched once or twice.

From *S. ænigma* Ludwig this species differs only in having a visible calcareous ring. *S. crucifera* Perrier, *S. horridus* Kœhler and Vaney, *S. robertsoni* Vaney, and *Bathyplores monoculus* Sluiter are allied to the present species, but in none of them have the fungiform papillæ been described, nor is the arrangement of the pedicels of the odd ambulacrum similar to that in this species. The species is named for Prof. Charles H. Gilbert of Stanford University.

Habitat.—South of Totomi, Honshu.

Type.—Cat. No. 34144, U.S.N.M.

Genus BATHYPLOTES Östergren.

6. BATHYPLOTES MOSELEYI (Théel).

Stichopus moseleyi THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 165–167, pl. 10, figs. 19, 20.

Bathyplores moseleyi ÖSTERGREN, *Zur Kenntnis der Synallactinæ*, 1896, p. 355.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 31–35, text-fig. 7.

Synallactes moseleyi PERRIER, *Holothuries antarctiques*, 1905, pp. 6–11, text-fig. A. *Synallactes*?, sp.? AUGUSTIN, *Japanische Seewalzen*, 1908, p. 20.

Station 5029. One specimen.

Station 5072. One specimen.

Station 5091. Fifty-five specimens.

Station 5092. Eighteen specimens.

Station 5093. Two specimens.

Station 5094. One specimen.

I can not find any generic difference between this species and others of the genus. Indeed, the presence of numerous pedicels along the odd ambulacrum is peculiar to the species, and Perrier referred it to *Synallactes* on that account, while Mitsukuri proposed to erect a genus *Östergrenia*. But I prefer to follow Östergren's original diagnosis of the genus, which covers the present species as well as *B. fallax* Östergren. The specimen reported by Augustin from Misaki seems to me to be a macerated one of this species.

Habitat.—West coast of Patagonia (Théel, 1886); between Navarin Island and Hoste Island (Perrier, 1905); various stations in Sagami Sea and Uruga Channel (Augustin, 1908; Mitsukuri, 1912); Suruga Bay; off Cape Terpyeniya, Sakhalin.

7. BATHYPLOTES TIZARDI (Théel).

Stichopus tizardi THÉEL, *Knight Errant Holothurioidea*, 1882, p. 696.

Bathyplores tizardi ÖSTERGREN, *Zur Kenntnis der Synallactinæ*, 1896, p. 354, pl. 13, figs. 36–43.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 35–39, text-fig. 8.

Herpysidia tizardi PERRIER, *Compt. rend. Acad. Sci., Paris*, vol. 126, No. 23, 1898, p. 1665.

Station 4959. One specimen.

Station 4966. Two specimens.

There is no need to add further details to what is known about this species. I may only mention a fact which seems to have some significance in connection with the breeding habit of the animal. In

the *male*, the mouth is closed by a circular fold of skin, forming, so to speak, a buccal cavity. Many eggs were found attached to the tentacles which were withdrawn into this cavity. The eggs measured 0.9–1 mm. in diameter.

Habitat.—Faroe Channel (Théel, 1882); Bay of Biscay (Kœhler, 1895); west coast of Morocco, Sahara, and Senegal (Perrier, 1902); Bergen (Östergren, 1896); Hardangerfjorden (Grieg, 1913); Sagami Sea (Mitsukuri, 1912); southwest of Shikoku; off Kii, Honshu.

8. BATHYPLOTES ÖSTERGREN, new species.

Plate 8, figs. 3a–d.

Station 4893. One specimen.

Station 4903. One specimen.

Body elongated, subcylindrical, only 21 mm. long and 4 mm. broad. Mouth subventral, anus terminal. Color dirty greenish-white. Integument smooth to the touch, with thick gelatinous subcutaneous tissue. Tentacles yellowish, only 19 in number, normal number probably 20. Pedicels none in the odd ambulacrum, in two rows in each ventrolateral ambulacrum. Papillæ forming 6 rows on dorsum. Besides these there are “fungiform papillæ,” 0.5–0.7 mm. in diameter, scattered along the sides of body. All these three kinds of appendages are very contractile and not prominent. Quadriradiate tablelike deposits are scattered in all parts of the perisome. In dorsum the deposit has 4 arms, which are expanded and perforated at end, and four-pillared spire with one or two cross-beams and some teeth on the top and sides. Diameter of base varies between 55 and 87 μ , with a mean of about 70 μ , and height of spire 33–47 μ . At the base of papillæ they are very large, with a diameter of as much as 143 μ , and a spire 70 μ high, with three cross-beams (pl. 8, figs. 3a, b). In walls of papillæ are found similar deposits with much reduced base and tall spire. Deposits of ventrum are very small and sparse; base usually disklike, pierced by four large holes; spire with one cross-beam (figs. 3c, d); diameter of base varies from 25 to 57 μ , with a mean of 34 μ , height of spire 20–23 μ . Tables in pedicels with many holes in disk, nearly equal in size to those of ventral perisome. Bent supporting rods armed with low spines are also found in pedicels and papillæ. Tip of pedicels with well developed end plate, 200–300 μ in diameter; papillæ with a cluster of irregular branched rods in tip. “Fungiform papillæ” usually without spicules, but sometimes with a branched rod instead of the end plate. Supporting rods of tentacles with more pronounced spines than in those of pedicels and papillæ. Radial segment of calcareous ring thick, H-shaped; interradians rodlike. Polian vesicles two in one of the specimens, one in the other. Stone-

canal with rather big madreporite not inserted to body-wall. Genital tubes in two tufts; respiratory trees two, well developed.

The present species is very closely related to *B. patagiatus* Fisher, from which it however differs (1) in having fungiform papillæ, (2) in the absence of marginal brim, and (3) in having no C-shaped deposit at all. The species also resembles *B. cinctus* and *B. roseus* both described by Kœhler and Vaney. I take pleasure in naming this species for Dr. A. Hjalmar Östergren of the Zoologiska Station, Kristineberg, Sweden, founder of the genus.

Habitat.—Off Goto Islands, west of Kyushu.

Type.—Cat. No. 34145, U.S.N.M.

Genus MESOTHURIA Ludwig.

9. MESOTHURIA MURRAYI (Théel).

Holothuria murrayi THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 185-186, pl. 10, figs. 16-18.

Holothuria murrayi (var. ?) THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 187-188, pl. 9, fig. 3.

Mesothuria murrayi ÖSTERGREN, *Zur Kenntnis der Synallactinæ*, 1896, p. 351.—SLUITER, *Siboga* Holothurien, 1901, p. 24.—FISHER, *Hawaiian Holothurians*, 1907, pp. 683-685, pl. 71, figs. 1, 1a-h.

Station 4903. One specimen.

Habitat.—West of Chile (Théel, 1886); off the Strait of Gibraltar (Théel, 1886); southeast of Flores, and Azores (Hérouard, 1902); Flores and Sulu Sea (Sluiter, 1901); Hawaii (Fisher, 1907); off Goto Islands, west of Kyushu.

10. MESOTHURIA PARVA (Théel).

Holothuria murrayi, var. *parva* THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 186-187, pl. 9, fig. 2; pl. 16, figs. 4, 5.

Mesothuria murrayi, var. *parva* PERRIER, *Travailleur* and *Talisman* Holothurioidea, 1902, p. 316.—AUGUSTIN, *Japanische Seewalzen*, 1908, pp. 18-20, text-fig. 14.

Mesothuria parva FISHER, *Hawaiian Holothurians*, 1907, pp. 686-687, pl. 71, figs. 2, 2a-c.

Mesothuria deani MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 40-42, text-fig. 9.

Station 5092. Twenty-eight specimens.

Station 5094. Eighteen specimens.

From the excellent descriptions and figures given by Fisher it is obvious that *M. deani* must be merged with this species.

Habitat.—Near Admiralty Island (Théel, 1886); Hawaii (Fisher, 1907); Misaki (Augustin, 1908); several stations in Sagami Sea, Uruga Channel, and Oshima (Mitsukuri, 1912).

11. MESOTHURIA MEDIA, new species.

Plate 8, figs. 4a, b.

Station 4968. One specimen.

Body 30 mm. long, 7 mm. broad, mouth and anus terminal, ventrum flat. Color grayish-white, ventrum a little lighter. Skin strongly

wrinkled, only very slightly rough to the touch. Tentacles 20. Numerous minute pedicels scattered all over the body without any zonal arrangement; they are largest on the ventrolateral ambulacra, being about 0.8 mm. long. Ventrum apparently naked, but the presence of scattered, rudimentary pedicels is indicated by small end-plates. Deposits in the form of tables quite richly present all over (pl. 8, figs. 4a, b). Disk is triangular with rounded angles, with a central hole and six peripheral ones. These latter are most commonly of different sizes, being alternately larger and smaller. Over the central hole is a triradiate arch, each arm of which gives rise to a pillar, united with its fellows by a cross-beam (fig. 4a). In dorsum, disks of tables measure 66μ in mean diameter, ranging $45\text{--}88\mu$, peripheral holes 5–8 in number, and height of spire $40\text{--}50\mu$. Those of ventrum are a little smaller, mean diameter of disks 54μ , range $41\text{--}65\mu$, number of peripheral holes 6–10, height of spire $30\text{--}40\mu$. In pedicels disk of tables is smaller, only $17\text{--}33\mu$ in diameter, peripheral holes being absent; spire $43\text{--}53\mu$ high, pillars not connected by cross-beams; no supporting rods, but the end-plate well developed with a large central hole. Rods in tentacles slender and bent, with numerous spines, often branched. Calcareous ring well developed. Polian vesicle single, stone-canal ending in a large ellipsoidal madreporite, which does not lie in dorsal body-wall. Genital tubes twice dichotomously divided, forming a tuft on the left side of dorsal mesentery.

It seems to me highly probable that in Perrier's genus *Zygothuria*, there may be indications of the presence of ventral pedicels, as in the present species. *M. multipes* Ludwig and *M. incerta* Kœhler and Vaney differ from this species in details of deposits. The present species also closely resembles *M. abbreviata* Kœhler and Vaney, which is somewhat imperfectly known.

Habitat.—Off Kii, Honshu.

Type.—Cat. No. 34146, U.S.N.M.

Genus PSEUDOSTICHOPUS Théel.

12. PSEUDOSTICHOPUS TRACHUS Sluiter.

Pseudostichopus trachus SLUITER, Tijdschr. Ned. Dierk. Ver., Dl. 7, Afl. 1, 1901, pp. 15–16; *Siboga* Holothurien, 1901, pp. 52–53, pl. 5, fig. 1; pl. 8, fig. 8.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 3–9, pl. 1, figs. 1–5, text-fig. 1.

Station 4968. One specimen.

Station 5055. Five specimens.

Station 5060. One specimen.

Station 5092. Fifty specimens.

Station 5093. One specimen.

Station 5094. Seven specimens.

Of these 65 specimens the largest measures only 70 mm. in length. In these specimens as well as in those examined by Professor Mit-

sukuri, end-plates are present in pedicels in most cases. They are rudimentary and are irregularly perforated, measuring at most 0.1 mm. in diameter. Besides the smooth, latticed plates in perianal region there are scattered smaller spinose bodies.

Habitat.—Moluccas and Timor (Sluiter, 1901); Sagami Sea (Mitsukuri, 1912); Suruga Bay; off Kii, Honshu.

13. *PSEUDOSTICHOPUS ALEUTIANUS*, new species.

Plate 8, figs. 5a-c.

Station 4768. Seventy-six specimens.

Station 4774. Three specimens.

Body flat and elongated, 73 mm. long, rounded at both extremities. Mouth ventral, anus lodged in a vertical pygal furrow. Body is thickly coated all over with sponge spicules and foraminiferan shells. Tentacles 20. Pedicels of ventrolateral ambulacra largest, about 1 mm. long, forming a double row. Scattered smaller papillæ (?) forming a double row along each dorsal ambulacrum. Scattered on the midventral ambulacrum, as well as on all interambulacra, are found very minute pedicels. X-shaped spicules present in wall of genital tubes, as in *Ps. occultatus* v. Marenzeller (pl. 8, fig. 5a). They vary in size from 60 to 150 μ . Around the anus are thinly scattered, irregular, X-shaped spicules (fig. 5b) and also irregularly rod-shaped ones (fig. 5c). Their length varies from 80 to 200 μ . Larger pedicels have end-plates attaining the diameter of 80 μ . Supporting rods of tentacles slender and bent, with low processes and often slitlike perforations. No deposits whatever are found in general perisome nor in respiratory trees. Calcareous ring similar to that of *Ps. trachus*. Polian vesicle single. Genital tubes not divided, in two tufts. Respiratory trees two.

The species differs from *Ps. occultatus* only in the absence of spicules from respiratory trees and in the character of the deposits in perianal region.

Habitat.—Aleutian Islands.

Type.—Cat. No. 34147, U.S.N.M.

14. *PSEUDOSTICHOPUS MOLPADIOIDES*, new species.

Plate 8, figs. 6a-c.

Station 4982. Eight specimens.

Body cylindrical, not flattened, rapidly tapering at both extremities, measuring 52 mm. in length, 25 mm. in breadth, and 20 mm. in height. Mouth terminal but directed ventrad, anus lodged in a rather inconspicuous vertical furrow. Color dirty pale brown, surface being covered all over with sand and foraminiferan shells, while sponge needles are very few. Tentacles 20. Small pedicels also

present in interambulacra thinly scattered, those belonging to the midventral ambulacrum being almost indistinguishable from them. Larger pedicels, up to 2 mm. long, form a double row on each ventrolateral ambulacrum. In the dorsal ambulacra smaller papillæ (?) are arranged in double rows. No deposits are present in general perisome or genital tubes. In larger pedicels an end-plate 140μ in diameter is present, and near it a few supporting rods (pl. 8, figs. 6a, b), $50\text{--}120\mu$ long, and always with a slight knob at the middle. Similar rods are found in tentacles, but these are much larger and are armed with short processes near the extremities. In the perianal region are found scattered irregular spiny bodies of varying complexity (fig. 6c), $60\text{--}200\mu$ in length. The simplest ones are X-shaped. Calcareous ring well developed, radial segments having a pair of accessory processes near the outer edge of the anterior end. Polian vesicle single, genital tubes undivided, in two tufts. Respiratory trees two, well developed.

The present species agrees in many respects with *Ps. pustulosus* Sluiter, but differs from it above all in lacking the series of large stout warts along each side of ventrum.

Habitat.—Off Shiribeshi, Hokkaido.

Type.—Cat. No. 34148, U.S.N.M.

15. PSEUDOSTICHOPUS ARENOSUS, new species.

Station 4915. One specimen.

Body more or less fusiform, 45 mm. long, 15 mm. broad. Mouth terminal but directing ventrad, anus situated in a vertical pygal furrow. Surface of body covered with numerous Globigerina shells and a few sponge needles, gray in color all over. Tentacles 20. There are conspicuous double rows of ambulacral appendages along paired ambulacra, of which the ventral ones have more crowded and larger pedicels, which may be as long as 1 mm. Along the odd ambulacrum no distinct row of pedicels can be found. Irregular spinous bodies similar to those in *Ps. molpadioides* and $50\text{--}175\mu$ long are found scattered in perianal region. Pedicels have end-plates only, which measure up to 90μ in diameter. Supporting rods of tentacles bear numerous knobs. No deposits are found elsewhere. Calcareous ring well developed, radials being very thick. Polian vesicle single, genital tubes undivided. Respiratory trees two.

The present species very much resembles *Ps. molpadioides*, only differing in the absence of supporting rods in pedicels and in details of rods in tentacles.

Habitat.—Off Koshiki Islands, west of Kyushu.

Type.—Cat. No. 34149, U.S.N.M.

16. *PSEUDOSTICHOPUS NUDUS*, new species.

- Station 4768. Seven specimens.
Station 4769. One specimen.
Station 4771. Four specimens.
Station 4772. One specimen.
Station 4774. Five specimens.
Station 4775. Five specimens.
Station 4781. One specimen.
Station 4966. Five specimens.

Body subcylindrical, almost uniform breadth throughout, both extremities rounded. Length 190 mm., breadth 50 mm., and height 30 mm. Mouth ventral, anus in a conspicuous pygal furrow. Surface of body almost naked, sometimes coated with very few sponge needles. Color whitish, often light yellow or brownish. Tentacles 20. Numerous pedicels form a broad zone along the midventral ambulacrum, there being about 8 pedicels in a transverse line. Toward the posterior part of body there is a groove along the median line. The pedicels are very peculiar in shape, each consisting of a number of oval, knoblike parts, 0.3–0.5 mm., united into a group measuring 1–2 mm. in diameter. Along lateral margin of ventrum are very low processes, often invisible, probably in alternate rows. Dorsal papillæ, 1–1.5 mm. long, forming a double row along each ambulacrum, very sparse, separated by intervals of about 10 mm. Supporting rods of tentacles are curved, slightly spinous, often with irregular branches. Near tip of papillæ are found slender rods usually with a knoblike thickening at the middle, but often irregularly branched. No deposits whatever are found elsewhere. Calcareous ring is of the usual form, each segment often with a pair of minute teeth on the posterior margin. Polian vesicle single, respiratory trees two. Genital tubes undivided, arranged in a row along each side of dorsal mesentery.

Some strongly contracted specimens show along each side of body a low thickened ridge, "bourrelet epais," as in *Ps. depressus* Hérourard. *Ps. pustulosus* Sluiter differs from the present species in shape and arrangement of ambulacral appendages.

Habitat.—Aleutian Islands; off Kii, Honshu.

Type.—Cat. No. 34150, U.S.N.M.

17. *PSEUDOSTICHOPUS UNGUICULATUS*, new species.

Plate 8, figs. 7a–c.

- Station 4960. One specimen.
Station 5083. Two specimens.
Station 5084. One specimen.

Body 90 mm. long, 35 mm. broad, ventrum flat, dorsum strongly vaulted. Mouth directed ventrad, anus situated in a deep pygal

furrow. Integument thin and translucent, gray in color, closely covered with fine granules, chiefly foraminiferan shells. Tentacles black, 20 in number. The animal is characterized by 18–20 conical warts arranged along the sides of ventrum, with four or five curved papillæ at the tip, about 2 mm. long, with black tips. In each dorsal ambulacrum run two rows of short, slender papillæ, about 25 in number. Near the lateral margin of ventrum pedicels measuring 1 mm. in length form a very sparse row. Scattered irregularly along the odd ambulacrum are found very minute pedicels only 0.3 mm. long. Dorsal and lateral papillæ contain only a very small number of smooth supporting rods, 80–100 μ in length (pl. 8, fig. 7c). Pedicels of ventrolateral ambulacra have imperfect end-plates about 100 μ in diameter, but contain no supporting rod. Rods in tentacles are richly armed with spines. In genital tubes are scattered branching calcareous bodies, normally X-shaped, with a knob at the middle (fig. 7a, b), 80–200 μ in length. Calcareous ring is of the usual form, each segment often with minute teeth on the posterior margin. Polian vesicle single, respiratory trees two. Genital tubes unbranched, arranged in a row along each side of dorsal mesentery.

The present species is perhaps identical with *Meseres peripatus* Sluiter, which has rows of warts beset with 4–5 clawlike papillæ. But the presence of a distinct pygal furrow, of spicules in genital tubes, and other differences in deposits appear to distinguish *P. unguiculatus* from it and all other allied forms.

Habitat.—Southwest of Shikoku; south of Totomi, Honshu.

Type.—Cat. No. 34151, U.S.N.M.

Genus CAPHEIRA Ludwig.

18. CAPHEIRA MOLLIS, new species.

Plate 9, figs. 16a, b.

Station 4767. One specimen.

Body elongated oval, rounded posteriorly. Length about 140 mm., width about 55 mm. Color dirty brown, tinged with yellow and green. Integument thin and finely wrinkled like crêpe, and highly delicate, apt to break even at a slight touch. Along ventrolateral ambulacra the body wall is slightly thickened. Tentacles 15, more or less shield-shaped, provided with 5 rounded digits. Very minute, pedicellike appendages, only 0.5–1 mm. long, are found scattered over the body except on midventral radius. Deposits of only one form, namely, triradiate tables, thickly overlapping one another. Disk with a small, round, central hole and oval peripheral ones, 6 to 12 in number (pl. 9, fig. 16a); diameter 107–220 μ , mean 160 μ . From the margin of the central hole arise three pillars, together making up a conical spire with always two crossbeams and a three-knobbed apex (fig. 16b). Height of spire varies 120–130 μ .

Calcareous ring consists of 15 saddle-shaped segments, each measuring 6 mm. by 4 mm., similar to those described in *C. sulcata* Ludwig. Polian vesicle single. Stone-canal calcified, ending in a knoblike madreporite attached to the body wall. Genital tubes branched many times, forming two tufts. I think I could make out a respiratory tree on the right side, though I can not be quite certain on this point, owing to the large mass of intestine which prevented more accurate observation.

From *C. sulcata* this species differs in shape and size of deposits and in number of tentacles. The genus resembles *Pseudostichopus* more than any of the forms of *Elasipoda*. Some aberrant forms of *Molpadiidæ* also show relationships with this genus.

Habitat.—Aleutian Islands.

Type.—Cat. No. 34152, U.S.N.M.

Genus PÆLOPATIDES Théel.

19. PÆLOPATIDES APPENDICULATA Théel.

Pælopatides appendiculata THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 158-159.—MITSUKURI, *Actinopodous* Holothurioidea, 1912, pp. 9-10.

(?) *Pælopatides purpureo-punctatus* SLUITER, *Siboga* Holothurien, 1901, pp. 43-44.

Station 4971. One specimen.

Station 5053. Two specimens.

Habitat.—South of Totomi, Honshu (Théel, 1886); Flores and Sulu Sea (Sluiter, 1901); Suruga Bay (Mitsukuri, 1912); off Kii, Honshu.

20. PÆLOPATIDES (?), species.

Station 5029. One specimen.

Station 5030. Two specimens and a fragment.

The largest specimen measures 90 mm. in length and the breadth is about 15 mm. throughout. Skin is totally scraped off, the transversely wrinkled muscle layer being exposed externally. Color of the anterior region including tentacles is grayish-purple, while the rest of body is yellowish-brown. Owing to maceration only 6 tentacles could be made out, and no trace of calcareous ring or deposits could be found. Musculature is well developed, each longitudinal muscle being 10 mm. wide and divided into two bands. Polian vesicle and stone-canal single. Though the whole digestive tube is wanting, its course seems to be normal, as judged from mesenteries left on the body wall. Genital organ rudimentary, respiratory trees 2, about 40 mm. long. The specimens are in too bad a condition for the pedicels and papillæ to be described.

Habitat.—Off Cape Terpyeniya, Sakhalin; east of southern Sakhalin.

Family DEIMATIDÆ Théel.

Genus DEIMA Théel.

21. DEIMA MOSAICUM, new species.

Station 4956. Five specimens.

Station 5084. One specimen.

Body elongated oval, 110 mm. long and 40 mm. wide in largest specimen. Mouth and anus situated on ventral surface. Integument thin, very brittle, covered with thin scale-like plates all over, grayish-white in color. Mouth is situated at the center of a circular ridge, 20 mm. in diameter, with papillæ of microscopic size on outer margin. Tentacles 18, each provided with 7–10 digits. The odd ambulacrum is naked, except for a pair of small pedicels only 2 mm. long, situated immediately anterior to the anus. Pedicels of ventrolateral ambulacra, measuring up to 20 mm. in length and 6 mm. across, numbering from 11 to 13 arranged in a row to a side. "Flankenpapillen" are long and cylindrical, up to 80 mm. in length and 7 mm. in diameter at base, 4 or 5 to each row. Another set "eigentliche Rückenpapillen," form a row on either side of mid-dorsal line, numbering 8 to 10 in each. All over the body, including pedicels and papillæ, skin is strengthened with scale-like plates, partly overlapping one another. Those of ventrum measure 0.8–2.0 mm. in diameter, those of dorsum 3–4 mm. or more. They are round, with almost entire margin and numerous holes increasing in size toward the center, and rarely attaining the diameter of 180μ . Each scale of dorsum consists of two parallel layers of network, of which the upper one is destitute of spinous processes on its surface. Those of ventrum lack the upper layer, but a few tubercles are always found at the central part. The scales of pedicels and papillæ are similar to those of ventrum except that the margin is serrated. Around the mouth the plates are very simple and oval, with thorny surface and margin, 0.3–0.5 mm. in diameter, accompanied by delicate, branched rods or plates with a few holes. Pedicel is devoid of end-plate but is supported by rods of various forms, sometimes by perforated plates. Supporting rods of tentacles have spinose processes. Genital tubes contain in their walls very delicate, thread-like branched rods often congregated to form a complicated apparent anastomosis. Calcareous ring consists of 10 fragile segments. Stone-canal strengthened by network of deposits; Polian vesicle single. Genital tubes thick and few in number, forming two tufts.

While the specimens agree very well with *D. blakei* Théel in the structure of dorsal scales and the number of papillæ, they show many other details which are common with *D. pacificum* Ludwig. The

much larger size of dorsal scales, the slenderness and length of papillæ, and the number of tentacles seem to be peculiar to the new species.

Habitat.—Southwest of Shikoku; south of Totomi, Honshu.

Type.—Cat. No. 34153, U.S.N.M.

Genus ORPHNURGUS Théel.

22. ORPHNURGUS INSIGNIS Fisher.

Orphnurgus insignis FISHER, Hawaiian Holothurians, 1907, pp. 702-706, pl. 73, fig. 1; pl. 77, figs. 1, 1a-e, 2, 2a-c, 3, 3a-e.

Station 4957. One specimen.

Station 4958. Ten specimens.

Station 4960. One specimen.

The largest in the collection measures only 85 mm. in length, being much smaller than those from Hawaii. Fisher found the dorsal papillæ to be "arranged in a fairly regular linear series along each of the two dorsal radii," except in two specimens with "a double row." But in the Japanese specimens the presence of double rows seems to be constant, as may be seen from an examination of the ampullæ from inside the body wall. The inner (median) row consists of 15-27 papillæ of various sizes, while the outer (lateral) is composed of a very variable number of much smaller ones. In the largest specimen I could find 15 and 17 papillæ in the outer rows, while in smaller ones there were only 5-10, or even none, apparently. Besides the characteristic deposits as fully described and figured by Fisher, I find minute, complicated bodies in longitudinal muscles. These are sometimes rodlike, sometimes four-armed, and bear many branches on the ends and processes along the sides. The length varies 60-200 μ .

Habitat.—Hawaii (Fisher, 1907); southwest of Shikoku.

23. ORPHNURGUS RIGIDUS, new species.

Station 4957. One specimen.

Station 4958. Two specimens.

Station 4959. Two specimens.

Station 5082. One specimen.

Body only 43 mm. long, of almost uniform breadth throughout, namely, 8 mm. Mouth ventral, with 20 nonretractile tentacles; anus terminal. Color grayish-white, tentacles light brown. Integument thin and stiff, armed with large rods, visible with naked eye. Pedicels nonretractile, 9 mm. long, 16-25, forming together a row along each side of ventrum. Very often, smaller ones alternate with the larger on the median side, so that a zigzag row is formed. The odd ventral ambulacrum is utterly devoid of pedicels. Above the lateral pedicels is a row of 13-17 flank papillæ on each side of body. Along each of the dorsal ambulacra papillæ are arranged in a double row, the inner consisting of 12-29, the outer of 6-17; a papilla may attain the length of 15 mm., and its base is conical and stiff, while

more distally it is soft and slender. Deposits in perisome are in the form of rods with both ends dilated and perforated, or rarely forked. Those of ventrum are robust, have more holes, and are more numerous than those of dorsum. Their length varies between 0.5 and 1.45 mm., often measuring 0.15 mm. across at the middle. In the posterior region they are more robust and short and very numerous. The rods of dorsum are slender, with a few terminal holes, length 0.4–1.25 mm., and even at the base of papillæ they are not of considerable length. These rods form groups of a few each, with their ends collected in a point. Very rarely some modified X-shaped rods are to be found in dorsum. The arms are not straight as in those of *Scotodeima setigerum* Ludwig, but always slightly curved. Diameter 240–430 μ as measured diagonally. Tentacles and pedicels are supported with larger straight rods and smaller bent ones, the former being 0.4–1.15 mm. long, and the latter only 0.2–0.6 mm.; end-plate is wanting. Supporting rods of papillæ are all straight; larger ones, 0.8–1.1 mm. long, gathered together in conical groups at base; smaller ones 0.25–0.6 mm. long, occurring sparsely in filamentous part. In genital tubes irregular branched rods, about 200 μ long, are sparsely present. Calcareous ring rather weakly developed, of spongy texture. Polian vesicle and stone-canal single. Genital tubes about five on each side of dorsal mesentery.

There are four species very much resembling the present species, all known by only one or two specimens each. These are *Scotodeima setigerum* Ludwig, *S. protectum* Sluiter, *S. vitreum* Fisher, and *Orphnurgus invalidus* Kœhler and Vaney. In the character of the deposits the present species stands between *O. invalidus* and *S. vitreum*, having several X-shaped bodies in dorsum. The presence or absence of a few small pedicels in the odd ambulacrum seems to be an unsafe guide in distinguishing genera, for Fisher has clearly shown the presence of 26 very small pedicels along that ambulacrum in *O. insignis*. It seems therefore likely to me that the genus *Scotodeima* should be merged into *Orphnurgus*.

Habitat.—Southwest of Shikoku; south of Totomi, Honshu.

Type.—Cat. No. 34154, U.S.N.M.

Genus PANNYCHIA Théel.

24. PANNYCHIA MOSELEYI Théel.

Pannychia moseleyi THÉEL, *Challenger* Holothurioidea, pt. 1, 1882, pp. 88–90, pl. 17, figs. 1, 2; pl. 32, figs. 1–13.—MITSUKURI, *Actinopodous* Holothurioidea, 1912, pp. 207–212.

Pannychia moseleyi, var. *henrici* LUDWIG, *Albatross* Holothurioidea, 1894, pp. 95–99, pl. 10, figs. 1, 2.

Station 5085. One specimen.

Habitat.—Off Sydney and northwest of New Zealand (Théel, 1882); Moluccas (Sluiter, 1901); near Cocos Island (Ludwig, 1894); Lower

California (Ludwig, 1894; Clark, 1913); near Oshima Island (Kishinouye, 1894); Sagami Sea (Mitsukuri, 1912).

25. *PANNYCHIA MOSELEYI VIRGULIFERA*, new subspecies.

Plate 8, figs. 8a,b.

Pannychia moseleyi EDWARDS, *Albatross Holothurians*, 1907, pp. 62-64.

Station 4768. Ten specimens.

Station 4769. Seven specimens.

Station 4770. Four specimens.

Station 4771. One specimen.

Station 4781. Six specimens.

Station 5015. Two specimens.

Station 5029. One specimen.

Station 5032. Five specimens.

Station 5033. One specimen.

Station 5036. One specimen.

Station 5039. Two specimens.

The largest specimen measures 210 mm. in length, 70 mm. in width, and 35 mm. in height. Color in life "pearly white with a bluish tint, papillæ reddish-purple;" in spirit some specimens almost retain their natural color, but others are white to light blue and rose, or brown. Ambulacral appendages purple in majority, but yellowish-brown in some. Tentacles 20. Pedicels of the ventrolateral ambulacra large, 25-40 in each. Along the midventral ambulacrum are 12-50 pedicels arranged in a zigzag or double row. Dorsal papillæ small, at most 3 mm. long, scattered all over, only leaving in some specimens narrow naked areas along the 3 interambulacra. Along the inner (median) side of dorsal ambulacra stand about 8 pairs of long whiplike papillæ, attaining the length of 20 mm. All the external and internal characters are those of *P. moseleyi*, but numerous "straight or arcuated, simple or branched, spinous" bodies (pl. 8, fig. 8a) occur in large numbers in all the specimens, uniformly scattered on ventrum. In some specimens they are highly spinous at ends, in others quite smooth (fig. 8b), and in rare cases three- or four-rayed. Length of these rods varies from 70 to 400 μ , with a mean of about 240 μ . Similar rods are also numerous in walls of pedicels.

The specimens above described differ from those of *P. moseleyi* only in having numerous rods in ventrum. In *P. moseleyi* the rods are never present in ventral perisome, but occur in small numbers in pedicels. I think that the specimens before me, together with a single specimen identified as *P. moseleyi* by Edwards, are to be distinguished as a northern form of that widespread species and deserve recognition as a subspecies.

Habitat.—Sitka, British Columbia (Edwards, 1907); Aleutian Islands; off Cape Terpyeniya, Sakhalin; east of southern Sakhalin; east and south of Hokkaido.

Type.—Cat. No. 34155, U.S.N.M.

Genus LÆTMOGONE Théel.

26. LÆTMOGONE VIOLACEA Théel.

Lætmogone violacea THÉEL, Bihang til kongl. Sv. Vet. Akad. Handl., vol. 5, 1879, p. 11; *Challenger* Holothurioidea, pt. 1, 1882, pp. 78-80, pl. 13, figs. 1-3; pl. 36, figs. 20-24; pl. 42, fig. 2.—PERRIER, *Travailleur* and *Talisman* Holothurioidea, 1902, pp. 390-398, pl. 19, figs. 1-7.—AUGUSTIN, *Japanische Seewalzen*, 1908, p. 21.—MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 192-198, pl. 6, figs. 52-54, text-fig. 36.

Cryodora spongiosa THÉEL, Bihang til kongl. Sv. Vet. Akad. Handl., vol. 5, 1879, p. 9.

Lætmogone spongiosa THÉEL, *Challenger* Holothurioidea, pt. 1, 1882, pp. 80-82, pl. 14, figs. 1-3; pl. 39, figs. 5-6.

Lætmogone jourdaini PETIT, Bull. Soc. Philomat., Paris, ser. 7, vol. 9, 1885, pp. 9-11.

Lætmogone brongniarti E. PERRIER, *Les Explorations sousmarines*, 1886, fig. 241.

Station 4919. One specimen.

Station 4957. One specimen.

Station 4958. One specimen.

Station 4960. One specimen.

Station 5082. Two specimens.

Station 5088. One specimen.

The specimens from Station 5082 are the largest ever recorded, being 170 mm. long and 45 mm. in breadth.

Habitat.—Off Sydney (Théel, 1879); Flores Sea and Moluccas (Sluiter, 1901); Andaman Islands (Walsh, 1891); Maldives (Kœhler and Vaney, 1905); west Greenland (Mortensen, 1913); north of Scotland (Théel, 1882); Bay of Biscay (Petit, 1885); from off Gibraltar along the west coast of Morocco and Sahara to Senegal, and Azores (Perrier, 1902); south of Totomi, Honshu (Théel, 1879); Sagami Sea (Mitsukuri, 1912); off Koshiki Islands, west of Kyushu; southwest of Shikoku.

27. LÆTMOGONE PARVA Mitsukuri.

Lætmogone parva MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 186-188, pl. 5, figs. 46-47, text-fig. 34.

Station 4956. One specimen.

The specimen is much larger than the original ones, measuring 68 mm. in length, 12 mm. in width, and 10 mm. in height. Integument is thick and gelatinous, of a gray color all over. At bases of tentacles and papillæ deep purple patches are to be seen. Tentacles 15, nonretractile. Papillæ retracted, about 20 in a row along the median side of each dorsal ambulacrum. Pedicels also retractile, quite minute, probably about 30 in each row along lateral margin of ventrum. Unlike the original specimens, the present one contains small, wheel-like plates scattered all over the dorsal perisome. They are precisely the same as those described by Mitsukuri, with a mean diameter of 76μ , and varying between $60-117\mu$. Peripheral holes are almost constantly 10 in number, but may in exceptional

cases increase to 11 or 12. The wheels in papillæ are smaller than those of perisome, measuring about 45μ . Pedicels contain numerous, well developed, bent, spinose rods and an end-plate. Ventral perisome is totally devoid of deposits. Genital tubes have also no deposits, each branched once or twice dichotomously near its base, and forming two tufts. Calcareous ring absent, represented by a connective tissue. Polian vesicle single and small. Other characters agree well with the original specimens.

Though differing in the number of papillæ and in distribution of deposits there is scarcely any doubt that the specimen belongs to the present species. The differences may be due to the age of the animal.

Habitat.—Several stations in Uruga Channel (Mitsukuri, 1912); southwest of Shikoku.

28. *LÆTMOGONE SELENKAI* Mitsukuri.

Lætmogone selenkai MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 189–192, pl. 5, figs. 48–51, text-fig. 35.

Station 4903. One specimen.

Station 4904. Six specimens.

The largest specimen is only 40 mm. long. The specimens differ from the original (first) in the size of the dorsal papillæ, which measure only 0.5–0.7 mm. in length and are much smaller than pedicels, which measure 3–4 mm. in length, and (secondly) in the size of the large wheels, which measure 80 – 280μ in diameter, thus attaining more than twice the size given for the original specimens. It may also be noticed that small wheellike plates are richly developed in radial muscles, and that delicate branching rods 180 – 320μ long are present in genital tubes.

L. neglecta Mitsukuri much resembles the present species, but differs in the number of spokes in the large wheels and in having rods in ventrum.

Habitat.—Uruga Channel (Mitsukuri, 1912); off Goto Islands, west of Kyushu.

Genus *ILYODÆMON* Théel.

29. *ILYODÆMON IJIMAI* Mitsukuri.

Ilyodæmon ijimai MITSUKURI, Annot. Zool. Japon., vol. 1, pt. 4, 1897, pp. 133–135; Actinopodous Holothurioidea, 1912, pp. 200–207, pl. 6, fig. 55, text-fig. 37.

Benthogone quatrolineata AUGUSTIN (not Perrier), Japanische Seewalzen, 1908, pp. 21–23, fig. 15.

Station 4968. One specimen.

Station 5088. Fifteen specimens.

Station 5090. One specimen.

Station 5092. Two specimens.

The largest specimen measures 105 mm. in length and about 30 mm. in breadth. Of the 4 rows of dorsal papillæ the inner (median) series

have a few more papillæ than the outer (lateral), the former consisting of 57–65 papillæ, and the latter of only 52–60 in each. Besides the deposits hitherto known, slender spinose rods occur in walls of genital tubes, and small wheellike plates are abundantly found in longitudinal muscles.

It is scarcely to be doubted that Augustin had before him a specimen of this species. His figure of the wheel was probably drawn from an incompletely developed one, in which the felly had not attained its full thickness.

Habitat.—Numerous stations in Sagami Sea (Mitsukuri, 1912); entrance of Tokyo Bay (Augustin, 1908); off Kii, Honshu.

30. ILYODÆMON MIURENSE, new species.

Plate 8, figs. 9a–c.

Station 5094. Five specimens.

Body very much like that of *I. ijimai* in external features, the largest specimen is 75 mm. long, 22 mm. broad; length therefore 2.5–3 times the breadth. Mouth ventral, surrounded with 15 almost uniform-sized tentacles; anus terminal. Color gray, dorsal papillæ violet. Lateral pedicels in a single series, 20 in each, largest ones 8 mm. long and 4 mm. across at base, diminishing in size backward. Papillæ form two rows along each dorsal ambulacrum, as long as the lateral pedicels but only half as thick. The inner (median) series consists of 33–36 papillæ, while the outer (lateral) one always contains fewer papillæ, viz, 20–26. Deposits of general perisome in 3 kinds—large wheels, small wheellike plates, and complicated rosettes. Large wheels (pl. 8, fig. 9a) are most numerous in ventrum, pedicels, and tentacles, less numerous in dorsum. Spokes most commonly 9, but may rarely vary from 7 to 12. Central holes are 6 in most cases, but may vary from 4 to 8. Of these 6, three are alternately larger and small, and over the larger ones there is a triradiate body which grows out from the “Mittelpfeiler” as in *I. maculatus* Théel.¹ In perisome diameter of these wheels varies between 160 and 260 μ , with a mean of 220 μ , while in pedicels and papillæ they are often as small as 60–80 μ . Small wheellike plates (fig. 9b) are as usual oval in outline, with 4 central and 12 peripheral holes. They are abundantly found in pedicels, papillæ, tips of tentacles, peristomial region, and radial muscles. Mean diameter 30 μ , range 24–45 μ . Complicated rosettes (fig. 9c) are found mingled with the small wheellike plates, and are nearly the same size as the latter. Tentacles and pedicels have bent spinous rods, often branched; papillæ destitute of them. Delicate, almost smooth, often branched, rods are found in peristomial region.

¹ Théel, 1882, pl. 36, fig. 15.

No deposits in genital tubes. Calcareous ring is of the common shape, Polian vesicle single. Genital tubes branched many times, forming two tufts, and opening on a papilla; near it also opens the stone-canal.

This species differs from *I. ijimai* in, first, the smaller number of dorsal papillæ, second, the presence of complicated rosettes, and third, absence of spicules from genital tubes. *I. maculatus* has the large wheels and complicated rosettes similar to those of the present species, but the dorsal papillæ are much more numerous, there being 140–150 in each ambulacrum.

Habitat.—Off Jogashima, Miura Peninsula, Sagami.

Type.—Cat. No. 34156, U.S.N.M.

Family ELPIDIIDÆ Théel.

Genus PENIAGONE Théel.

31. PENIAGONE JAPONICA, new species.

Plate 9, fig. 10.

Station 4974. Three specimens.

Station 5083. One specimen.

Station 5084. Seven specimens.

The anterior end of body is bent ventrad, and in its center opens the mouth. On the dorsal side of the necklike region there is a transverse series of four papillæ, 10–14 mm. long, connected together at bases by a weblike fold; two more pairs of minute papillæ immediately behind. Along each side of body a lateral brim separates the ventral from the dorsal surface. Length of body 55 mm., width about one-third the length. Color pale white all over. Integument thin and soft, slightly rough to the touch. Tentacles large, probably 10; only 6 could be made out owing to bad preservation. About 8 pedicels form a single row along each side of the posterior half of body, beneath the lateral brim. The anteriormost ones are largest, measuring about 4 mm. in length. Deposits in dorsum are of two kinds, lying in distinct layers. The superficial ones are of the common shape, consisting of a short central rod and 4 bent thorny arms, each with a shorter vertical process near the base. The arms are 120–200 μ long, the vertical processes 70–120 μ . The deeper layer consists of scattered, large X-shaped bodies (pl. 9, fig. 10). The arms are straight, bear minute teeth near the free end, and measure 140–520 μ in length, sometimes much shorter, being only 60 μ . The central rod is less variable in length, commonly 50 μ , but ranging between 40 and 80 μ . In ventrum, pedicels, and stalks of tentacles are found only those corresponding to the superficial ones of dorsum. The arms are but slightly bent downward, measuring 90–140 μ long, with vertical processes 20–50 μ long. Papillæ and tips of tentacles are beset with

curved, spiny rods often branched, sometimes X-shaped. Very rarely, simple, spiny, unbranched rods are found besides the four-rayed spicules. In genital tubes are found slender X-shaped bodies like those known in *P. intermedia* Ludwig. Their arms measure 100–340 μ . Calcareous ring consists of 5 radial segments only, 1 mm. in length, with numerous, branched projections. Stone-canal rather large, not specially strengthened with spicules, opens externally about midway between tentacular crown and dorsal brim. Polian vesicle single. Radial muscles well developed, dorsal pair divided, others simple, midventral one being much more slender. Genital tubes borne on two large branches of the wide duct, which opens near the madreporic aperture.

P. azorica v. Marenzeller and *P. purpurea* (Théel) are very close to the present species but differ above all in the absence of the lateral brims. *P. atrox* Théel, *P. expansa* Kœhler and Vaney, and *P. intermedia* Ludwig have lateral brims, but differ in shape of spicules.

I refer the specimen from station 5083 to this species with much doubt. Spicules of this specimen are asymmetrical in having only three vertical processes. Probably this may be a different and unrecorded species.

Habitat.—Off Kii, Honshu; south of Totomi, Honshu.

Type.—Cat. No. 34157, U.S.N.M.

Genus ACHLYONICE Théel.

32. ACHLYONICE MONACTINICA, new species.

Plate 9, figs. 11a–c.

Station 4974. One specimen.

Station 5084. Sixteen specimens.

Body elongated, length 100 mm., about 3.5–4 times the width. Anterior end strongly bent ventrad, mouth terminal but ventral, anus slightly turned dorsad. Dorsum much vaulted, but flattened at the posterior part. Color uniformly pale white, integument opaque, smooth to the touch. Tentacles 12, nonretractile, connected with one another by a membranous fold of skin, except the smaller 4 of the ventral side, which are free. Tips of tentacles light yellow. On the dorsal side of the necklike part there is a transverse fold of skin with two pairs of papillæ. The papillæ of the anterior (median) pair are short and project but little from the skin fold as a very short conical process, while the second pair, which are posterolateral to the former, are 15 mm. in their free parts. There are two more pairs of minute papillæ behind the large ones just mentioned. Pedicels confined to the posterior half of body, in a row along each side of ventrum, 10–13 in each row, most commonly 11. The anteriormost are largest, 7.5 mm. long and 4 mm. across. The only deposits are slender, unbranched rods with some spines (pl. 9, fig. 11c); though very rarely

there may be a branch (figs. 11*a*, *b*), never symmetrically triradiate. They are very sparsely scattered in general perisome, tentacles, pedicels, radial muscles, peritoneum, and genital organ. In general perisome they vary in length between 100 and 280 μ , but are most commonly 150–170 μ . In dorsum they are more sparse and slender. In tentacles, papillæ, and pedicels the rods are of a similar shape, but larger, 200–300 μ , and more numerous. No end-plate in pedicels. Spicules in genital tubes and duct are numerous, delicate, usually branched, and spinose (fig. 11*a*), 120–240 μ in length. The walls of intestine, cloaca, and stone-canal are destitute of deposits. Calcareous ring consists of 5 radials only, which have 6 pairs of simple or only bifurcated processes. Stone-canal minute, meandering in course, opening midway between anterior end and dorsal skin fold. Polian vesicle single. Genital tubes short, once or twice branched, forming some 15 tufts attached to a long, wide genital duct, measuring over 100 mm. in length and 5 mm. in diameter. Mesentery represented by a number of ribbonlike filaments, 1–1.5 mm. in width. Cloaca provided with an inconspicuous cœcum. Radial muscles thick, dorsal pair 9 mm. wide and divided, the others not. The mid-ventral one is markedly slender in the anterior half.

From the two hitherto known species of the genus, *A. ecalcare* (Théel) and *A. lactea* Théel, the present species differs in having no symmetrical triradiate deposits.

Habitat.—Off Kii; south of Totomi, Honshu.

Type.—Cat. No. 34158, U.S.N.M.

Genus SCOTOPLANES Théel.

33. SCOTOPLANES THÉELI, new species.

Station 5032. Six specimens.

Station 5033. Three specimens.

Body ovate, posterior half broader than the anterior. Length 80 mm., width 30 mm., the latter never exceeding one-half of the former. Dorsum vaulted, ventrum flat, mouth and anus terminal but directed ventrad. Color light brownish-gray all over; integument very thin and soft. Tentacles 10, terminal disk with 10 marginal digits and a number of knob-like processes in the central part. Pedicels 7, rarely 6, forming a row along the whole length on each side of ventrum; they decrease in size from the anteriormost ones, which measure 15 mm. long and 7 mm. across at base, backward, the last one being often quite rudimentary. Dorsal papillæ invariably in 3 pairs, the first being situated at about the middle of the anterior half of body, the second, at the middle of body or more commonly a little more anteriorly. Both these pairs are long, measuring 23 mm., and 4 mm. across at base. The third pair stand immediately behind the second but are slightly more lateral in position,

and measure about 8 mm. in length. Numerous C-shaped deposits are found in general perisome, tentacles, papillæ, pedicels, and genital organ, and very rarely in peritoneum, but never present in intestine. Diameter of these deposits measures 45–130 μ , most commonly 80–100 μ . Mingled with these but less numerous are straight or curved, unbranched and spinose rods, 140–880 μ long, most commonly 400–600 μ . No other kind of deposits is found. Calcareous ring made up of five radials only, which have four pairs of branching processes. Stone-canal opens about 10 mm. behind the tentacular crown. Polian vesicle single. Intestine connected to body-wall by means of numerous filaments, instead of mesentery; cloaca globular but without cœcal appendage.

There is a remarkable agreement in every character between the present species and *S. globosa* Théel. The two forms differ from each other only, first, in relative width of body to length; second, in position of the second and third pairs of papillæ; and, third, in development of cœcal appendage. The species may therefore better be separated, and is named in honor of Prof. J. Hjalmar Théel, of the Naturhistoriska Riks-Museum, Stockholm, for his splendid work on the deep-sea holothurians.

Habitat.—Nemuro Strait, east end of Hokkaido.

Type.—Cat. No. 34159, U.S.N.M.

Genus ENYPNIASTES Théel.

34. ENYPNIASTES EXIMIA Théel.

Enypniastes eximia THEEL, *Challenger* Holothurioidea, pt. 1, 1882, pp. 56–57, pl. 8, figs. 6, 7.—SLUITER, *Siboga* Holothurien, 1901, pp. 77–79, pl. 2, figs. 8, 9; pl. 10, fig. 5.—MITSUKURI, *Actinopodous* Holothurioidea, 1912, pp. 215–218, pl. 7, figs. 59, 60.

Station 4906. Nine specimens.

Station 4907. Twelve specimens.

Station 4914. Two specimens.

Body up to 90 mm. in length. In a specimen preserved in formalin, color is totally gone. One can clearly make out 12 papillæ forming together a large brim, median genital papilla, 3 pairs of dorsal papillæ, and 8 pairs of pedicels rather crowded near the posterior end of body. In all the other specimens, which are preserved in alcohol, the ground color is reddish-violet, which is specially intense on pedicels and papillæ, and replaced by dark brown in tentacles. The most striking fact is that the ovarian ova are of considerable size, exceeding all records for holothurians, being 3–3.5 mm. in diameter.

As it is difficult in such highly delicate animals to make out in preserved specimens the real disposition of appendages, it is rather doubtful to me whether the genus *Euriplastes* Kœhler and Vaney can really be kept separate from *Enypniastes*.

Habitat.—New Zealand (Théel, 1882); Moluccas (Sluiter, 1901); northern parts of Suruga Bay, Japan (Mitsukuri, 1912); off Koshiki Islands, west of Kyushu.

Family PSYCHROPOTIDÆ Théel.

Genus PSYCHROPOTES Théel.

35. PSYCHROPOTES RARIPIES Ludwig.

Psychropotes raripes LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, pp. 107-108; *Albatross* Holothurioidea, 1894, pp. 48-51, pl. 5, figs. 1-16.

Station 5030. Five specimens.

The largest specimen in formalin measures 195 mm. in length of body proper, 75 mm. in length of tail, 45 mm. in width of body. Minute dorsal papillæ 4-8 in each row. Pedicels of the lateral margin of sole up to 9 on each side, but usually 7. Those of the odd ambulacrum in 15-20 pairs, most commonly 18 or 19. The anterior brim contains 28 pedicels, in one exceptional case only 25. Other characters are in full agreement with the original description of Ludwig. Deposits almost entirely dissolved in all the specimens, only leaving some traces.

Habitat.—Gulf of Panama (Ludwig, 1893); east of southern Sakhalin.

Genus EUPHRONIDES Théel.

36. EUPHRONIDES DEPRESSA Théel.

Euphronides depressa THÉEL (part), *Challenger* Holothurioidea, pt. 1, 1882, pp. 93-96, pl. 26, figs. 1, 2.¹—PERRIER, *Travailleur* and *Talisman* Holothurioidea, 1902, p. 434.

Euphronides tanneri LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, p. 107; *Albatross* Holothurioidea, 1894, pp. 39-44, pl. 3, fig. 7; pl. 4, figs. 17-19.

Station 5084. Twenty-three specimens.

Length of body up to 210 mm., breadth 85 mm. Pedicels of the odd ambulacrum about 35 pairs, varying 25-40. Lateral brim with about 45 pedicels. Dorsal papillæ in most cases 4 or 5 to each side, but sometimes 6, posterior ones very often of considerable size. In one individual the posteriormost one is 20 mm. long and 10 mm. in diameter at base, in others quite small, being only 5 mm. long and 2.5 mm. across. The large unpaired papilla is also very variable in size as well as in shape. It may be 40 mm. long and 25 mm. broad. In only 3 of the 23 specimens is this papilla single-pointed (text-fig. D); in another the bifurcation is only slightly indicated at tip (fig. C);

¹ The spicules represented in figs. 5 and 6, pl. 35, are those of an Atlantic specimen which is referred by Perrier to *E. auriculata*.

in all the others it is divided in varying degrees at tip (fig. B), and in one extreme case the division is carried half way down the whole length of the papilla (fig. A). Ovarian ova 2.5 mm. in diameter. Deposits are exactly the same as those described and figured by Ludwig for his *E. tanneri*, except that I could not find any stunted bodies in genital organ.

Ludwig's specimen seems to belong to the same species as the two original specimens of Théel, secured from off the coast of Chile and rather imperfectly reported. Since the size and shape of dorsal papillæ are very variable, I am convinced that the Atlantic forms, *E. cornuta* Verrill, *E. depressa*, var. *minor* Théel, *E. auriculata* Perrier,



FIG. 1.—EUPHRONIDES DEPRESSA. DORSAL UNPAIRED PAPILLA FROM VARIOUS INDIVIDUALS, SHOWING VARIATION IN DEGREE OF BIFURCATION. $\times 1$.

E. violacea Perrier, and *E. talismani* Perrier are identical with one another.

Habitat.—Off the coast of Chile (Théel, 1882); north of Cape San Francisco (Ludwig, 1893); south of Totomi, Honshu.

Genus BENTHODYTES Théel.

37. BENTHODYTES SANGUINOLENTA Théel.

Benthodytes sanguinolenta THÉEL, *Challenger* Holothurioidea, pt. 1, 1882, pp. 104–105, pl. 23; pl. 40, figs. 4, 5; pl. 42, fig. 6.—LUDWIG, *Albatross* Holothurioidea, 1894, pp. 53–60, pl. 1, figs. 1–8.

Station 4971. Four specimens.

Station 4972. One specimen.

Station 4973. Five specimens.

To the excellent description given by Ludwig a few additions may be made. Sparsely scattered rods are found not only in walls of tentacles and genital tubes but also in the intestinal blood vessels. These deposits are similar in shape to those in other parts, measuring $150\text{--}250\mu$ in length. In the largest specimen, 210 mm. long, the cæcal appendage of cloaca measured 40 mm. long and 6 mm. across, with its apex divided into two branches about 5 mm. long. The large ovarian ova measure 2.2 mm. in diameter, as stated by Ludwig.

Habitat.—Off the coast of Chile (Théel, 1882); Panamic region (Ludwig, 1894); Lower California (Clark, 1913); Bengal Bay (Walsh, 1891); Laccadives and Andaman Islands (Kœhler and Vaney, 1905); off Kii, Honshu, Japan.

38. BENTHODYTES GOTOI, new species.

Plate 9, fig. 12.

Station 5030. Four specimens.

Body rather long, 195 mm., with the uniform breadth of about 35 mm. throughout. Ventrums flat, dorsum strongly vaulted, probably exaggerated by contraction. Mouth ventral, anus dorsal. Color of the anterior region, tentacles, and pedicels dark violet, other parts light violet-gray. Integument thin and soft, smooth to the touch. Only the apices of dorsal papillæ are very rough, spines of deposits, perceptible with naked eye, protruding through epidermis. Tentacles 15, more or less retractile. Pedicels of the odd ambulacrum retractile and minute, 50 or more in number, arranged in a zigzag row, none in the anterior region. Those forming the lateral brim number more than 50 to a side. Papillæ in a single row along each dorsal ambulacrum, of two different sizes. In each row there are 5–8 large conical papillæ with rounded ends, up to 12 mm. long and 8 mm. across, and 1–5 filiform ones, only 2 mm. long, confined to the anterior region. Some of these filiform ones are very often situated on the wall of a larger papilla. The total number of the papillæ of these two sorts is usually 9 or 10, in one case up to 14, to a side. Deposits in general perisome of dorsum are spinose cruciform bodies with an anchor-shaped spire (pl. 9, fig. 12), reminding one of the spicules of *Euphronides anchora* Hérouard. The arms are arcuated and spinous, measuring together with its fellow of the opposite side 200–360 μ in length. The spire is 100–130 μ long, with a pair of arched arms provided with 3–4 pairs of minute teeth along their concave side, and a few more minute ones near the apex. The span length of the anchor arms measures about 100 μ . These spicules are extremely scanty, only one or two in each 50 square mm. of area, and even in the anterior brim, where they are more numerous, only 10 spicules are found in the same extent of area. On tips of large papillæ are found gigantic spicules exactly of the same form as those described by Sluiter in his *B. hystrix*.¹ In these the length of an arm measures 0.3–0.8 mm., and may reach 1 mm.; central spire 250–550 μ long usually bifurcated for one-half of its length. Some small anchor-bearing spicules similar to those of perisome are also found at tips of large papillæ. The smaller papillæ have small spinose, cruciform spicules or simple unbranched rods, all with spinose arms but lacking a central spire. In ventrum are found very rarely, unbranched spinose rods measuring 250–550 μ in length. Supporting rods of tentacles, up to 1 mm. long, with a few spines at both ends. Egg follicles and genital duct with thinly scattered, delicate, cruciform spicules in the walls, one of the pairs of arms being very often shorter than the other; length of spicules 270–480 μ . No deposits in walls of intestine.

¹ *Siboga* Holothurien, 1901, pl. 9, fig. 10a.

Polian vesicle and stone-canal single. The female genital organ consists of a large duct on each side, and a dozen or more follicles attached to each of them. Ova are large, 2.5 mm. or more in diameter.

B. hystrix is very closely allied to the present species, differing only in having the dorsal perisome "rauh durch die hervortretenden Nadeln der Kalkkörperchen," which are visible to naked eye. From it and other allied species, *B. lingua* Perrier, *B. janthina* v. Marenzeller, and *B. sordida* Théel, my species differs above all in having characteristic anchor-bearing spicules. The species is named for Prof. Seitaro Goto of the Tokyo Imperial University.

Habitat.—East of Southern Sakhalin.

Type.—Cat. No. 34160, U.S.N.M.

Family HOLOTHURIIDÆ Ludwig.

Genus HOLOTHURIA Linnæus.

39. HOLOTHURIA MONACARIA (Lesson).

Psolus monacaria LESSON, Centurie zoologique, 1830, p. 225, pl. 78.

Holothuria monacaria JÆGER, De Holothuriis, 1883, p. 24.

Holothuria decorata v. MARENZELLER, Neue Holothurien von Japan und China, 1881, pp. 137-139, pl. 5, fig. 12.

Station 4937. One specimen.

Station 4946. One specimen.

*Habitat in Japan*¹.—Japan (Théel, 1886); Enoshima (v. Marenzeller, 1881); Okinose, Sagami Sea (Clark, 1908); Doketsuba, Sagami Sea; Misaki; Kominato, Boshu; Hommura, Awaji; Oita and Sagano-seki, Kyushu; Iki Island (Mitsukuri, 1912); Nagasaki (Britten, 1907); Kagoshima Bay.

Family STICHOPIDÆ Östergren.

Genus STICHOPUS Brandt.

40. STICHOPUS JAPONICUS Selenka.

Stichopus japonicus SELENKA, Beiträge zur Anatomie und Systematik der Holothurien, 1867, p. 318, pl. 18, figs. 33-36.—MITSUKURI, Annot. Zool. Japon., vol. 1, pts. 1-2, 1897, pp. 31-42; Actinopodous Holothurioidea, 1912, pp. 163-171, pl. 4, figs. 32-44, text-fig. 29.

Holothuria armata SELENKA, Beiträge zur Anatomie und Systematik der Holothurien, 1867, p. 330, pl. 18, fig. 66.

Stichopus japonicus, var. *typicus* THÉEL, Challenger Holothurioidea, pt. 2, 1886, pp. 161-162, pl. 8, fig. 2.

Stichopus armatus AUGUSTIN, Japanische Seewalzen, 1908, pp. 10-11.

Stichopus roseus AUGUSTIN, Japanische Seewalzen, 1908, pp. 13-14, text-fig. 10.

Tsuruga. One specimen.

The specimen is much contracted, only 95 mm. long, in the typical "III. stage" of development according to Mitsukuri's terminology. Deposits are of three kinds; first, complete tables with round disk and

¹ For other localities see Mitsukuri, Actinopodous Holothurioidea, 1912, pp. 117-118.

high spire; second, somewhat smaller tables with serrated disk and imperfect spire; and third, four-holed buttons without spire. Of these three kinds the last named are most abundant.

Augustin seems to have had before him specimens of various stages of development. His *S. roseus* is based on young specimens of this common species.

Habitat.—Amboina? (Lampert, 1885); Hongkong (Théel, 1886); Sitka (Clark, 1902); Hakodate (Selenka, 1867); Yokohama (Ludwig, 1887); Jogashima and Aburatsubo, Misaki (Augustin, 1908); southern Sakhalin and east coast of Korea (Britten, 1908); numerous localities on the coasts of Japan, from the Kuriles to Kagoshima, the southernmost part of Kyūshū, including Sakhalin and east coast of Korea to Vladivostok (Mitsukuri, 1912).

41. *STICHOPUS NIGRIPUNCTATUS* Augustin.

Plate 9, figs. 13a, b.

Stichopus nigripunctatus AUGUSTIN, Japanische Seewalzen, 1908, pp. 7–8, pl. 1, fig. 2, text-fig. 5.

Stichopus depressus AUGUSTIN, Japanische Seewalzen, 1908, pp. 11–13, pl. 1, fig. 4, text-figs. 8–9.

Stichopus owstoni MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 175–178, pl. 2, figs. 18–20, text-fig. 31.

Station 4940. One specimen.

Station 4941. Two specimens.

Station 5046. One specimen.

Station 5092. Six specimens.

Station 5094. Three specimens.

No label. One specimen.

The largest specimen measures 260 mm. long, 60 mm. broad, and 50 mm. in thickness. Some of the specimens from station 5092 are quite young, the smallest being only 27 mm. long. Number of lateral papillæ varies 17–27 on each side, but is much reduced in young ones. In the smallest specimen there are only 12 lateral papillæ, and on each dorsal ambulacrum about 10 papillæ of similar size are arranged in a zigzag row. Distribution of pedicels agrees well with the statements of preceding authors. In the youngest specimen, however, pedicels are in a double row in midventral ambulacrum, and in a single row in each ventrolateral ambulacrum, alternating with the lateral papillæ.

A noteworthy fact in this species is the change which the calcareous deposits undergo during the growth of the animal. In the youngest specimen above mentioned, the deposits of the body wall as well as of the pedicels and papillæ are all well developed tables (pl. 9, figs. 13a, b). The disk is large and round, with entire margin; 60–135 μ in diameter. The spire consists of 4 pillars, connected with each other by 3 or 4 crossbeams, 50–65 μ in height. In an advanced stage, represented by a specimen 70 mm. long, there are found two sorts of tables,

between which various intermediate forms are to be found. One sort is similar in shape to those found in the foregoing stage, and generally lie in a deeper part. The other is of the same form as those found in larger specimens, and these are more numerous than the large round tables. In specimens of a still more advanced stage, about 130–150 mm. long, the round tables are very rarely found between those of another form. In full-grown specimens there is only one kind of table, the second sort, with small serrated disk and plump spire, as figured by previous authors (Augustin, text-figs. 5, 8; Mitsukuri, text-figs. 31*b*, *c*). The margin of the disks varies in the degree of its serration in different individuals (compare with *S. depressus*). In rare cases the spire is totally absent, the deposit thus becoming a mere perforated plate. Diameter of disks of these tables varies 46–106 μ , height of spire, 40–60 μ .

Habitat.—Numerous stations in Sagami Sea (Augustin, 1908; Mitsukuri, 1912); Ibaraki Prefecture; Aomori Prefecture; Provinces Noto and Ettchu (Mitsukuri, 1912); Kagoshima Bay; off Ojika Peninsula.

Family MOLPADIIDÆ J. Müller.

Genus MOLPADIA Cuvier.

42. MOLPADIA RORETZII (v. Marenzeller).

Haplodactyla roretzii v. MARENZELLER, Denkschr. d. k. Akad. d. Wiss., vol. 35, 1877, p. 387, pl. 4, fig. 1.

Ankyroderma roretzii v. MARENZELLER, Neue Holothurien von Japan und China, 1881, pp. 124–126, pl. 4, fig. 4.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 267–275, pl. 8, fig. 78, text-fig. 55.

Ankyroderma simile THÉEL, Challenger Holothurioidea, pt. 2, 1886, pp. 40–41, pl. 2, fig. 5; pl. 11, fig. 2.

Molpadia similis CLARK, The Apodous Holothurians, 1907, p. 163, pl. 10, fig. 16.

Molpadia roretzii CLARK, The Apodous Holothurians, 1907, p. 164.

- Station 4832. One specimen.
- Station 4945. One specimen.
- Station 5055. One specimen.
- Station 5059. Twelve specimens.
- Station 5067. Two specimens.
- Station 5069. Two specimens.
- Station 5092. One specimen.

The largest specimen measures 120 mm. in length, inclusive of the caudal appendage, which is 17 mm. long. Racket-shaped calcareous bodies in rosette-shaped groups of about 5 each, but varying from 3 to 7, mean length 485 μ , varying between 320 and 740 μ . Anchors measuring 260–495 μ in length, with a mean of 370 μ ; span of the arms 110–180 μ , with a mean of 140 μ ; and the base 70–80 μ in diameter. Scattered tables with from 1 to 9 holes, usually 4, in their small disks. Diameter of disks 46–270 μ , averaging 120 μ . Spire is 70–130 μ , with

2-6 crossbeams. The shape of these tables is also subject to a rather wide range of individual variation. Elongated tables in caudal appendage $150-330\mu$ in length, anal teeth 500μ long and 150μ broad. Phosphatic corpuscles are uniformly distributed in young specimens, while in older ones they are aggregated into patches of about 300μ in diameter.

Habitat.—Japan (v. Marenzeller, 1881); Sagami Sea (Théel, 1886; Augustin, 1908; Mitsukuri, 1912); off Echizen, Honshu; Kagoshima Bay; Suruga Bay.

43. *MOLPADIA INTERMEDIA* (Ludwig).

Trochostoma intermedium LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, p. 113; *Albatross* Holothurioidea, 1894, pp. 161-164, pl. 16, figs. 7-21.

Molpadia intermedia CLARK, The Apodous Holothurians, 1907, pp. 33-34, 162, pl. 12, figs. 5-15.

Station 5039. Five specimens.

All the specimens are large, total length of body being 100-125 mm. Color uniformly grayish-purple. As unfortunately the deposits had been totally dissolved when the specimens were examined by me, my observations were made on a single preparation mounted by the late Professor Mitsukuri, and are imperfect. Scattered tables of perisome measure $60-105\mu$ in diameter, while those in caudal appendage are $110-230\mu$, spire 80μ high. Except in the oral and caudal parts, skin thickly beset with phosphatic corpuscles, not unfrequently exceeding 160μ in diameter.

Habitat.—Gulf of Panama (Ludwig, 1894); Gulf of California (Ludwig, 1894; Clark, 1913); numerous stations along the Pacific coast of North America (Clark, 1907); off Hitaka, south of Hokkaido.

44. *MOLPADIA MUSCULUS* Risso.

Molpadia musculus RISSO, Histoire Naturelle de l'Europe mérid., 1826, p. 293.—CLARK, The Apodous Holothurians, 1907, pp. 34-35, 165-166, pl. 11, figs. 2-4, 6-7, 14.

Molpadia violacea STUDER, Monatsber. d. königl. Akad. d. Wiss., Berlin, 1876, p. 454.

Ankyroderma danielsseni THÉEL, Challenger Holothurioidea, pt. 2, 1886, pp. 39-40, pl. 2, figs. 6a-g.

Ankyroderma musculus LUDWIG, Zeitschr. f. wiss. Zool., vol. 51, 1891, pp. 569-591, pl. 29, figs. 1-11.—PERRIER, Travailleur and Talisman Holothurioidea, 1902, pp. 529-533, pl. 22, figs. 16-22.—KÖHLER and VANEY, Les Holothuries de mer profonde, 1905, pp. 95-97.

Station 5030. Seven specimens.

The largest specimen is 70 mm. long. All these specimens lack phosphatic corpuscles completely. Anchors and rosettes of racket-shaped bodies are also wanting. The characteristic spindle-shaped deposits of general perisome measure 0.63-1.55 mm. in length, aver-

aging 1.2 mm., with 5 (3–10) holes. Very rarely in some individuals there rises from the center a solid spire with a knoblike top. Among these deposits are found small tablelike bodies, with a disk up to 0.2 mm. in diameter, perforated by 3 large holes. Spire is armed at the apex with 6 hooks. In caudal appendage rods are smaller and simpler, less than 0.8 mm. in length. Anal teeth measure only 0.4 mm. in length.

Habitat.—Nice (Risso, 1826); Naples (Grube, 1840; Ludwig, 1891); Palermo (Grube, 1850); Marseille (Jourdan, 1883); coasts of Portugal, Sahara, and Senegal (Perrier, 1902); Kerguelen Islands (Studer, 1876; Théel, 1886); New Zealand (Théel, 1886); off Chile (Théel, 1886; Clark, 1907); from the Gulf of Panama, Cocos and Galapagos, to California (Ludwig, 1894; Clark, 1907, 1913); numerous stations along the coasts from the Gulf of Aden to Andaman Islands (Kœhler and Vaney, 1905, 1910); east of southern Sakhalin.

45. MOLPADIA SPINOSA (Ludwig).

Ankyroderma spinosum LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, pp. 113–114; *Albatross* Holothurioidea, 1894, pp. 171–173, pl. 17, fig. 10; pl. 18, figs. 1–12.—SLUITER, *Siboga* Holothurien, 1901, p. 120.—KÖHLER and VANEY, Les Holothuries de mer profonde, 1905, pp. 96, 97.

Molpadia musculus CLARK (part), The Apodous Holothurians, 1907, pp. 34–35, 166, pl. 11, figs. 1, 5, 9–13; Bull. Amer. Mus. Nat. Hist., vol. 32, 1913, pp. 228–229.

Station 5057. One specimen.

The body proper measures only 21 mm. in length, while the caudal appendage is 7 mm. long. Numerous tablelike deposits of general perisome (Ludwig, pl. 18, figs. 1–8) measure 200–350 μ in diameter, with a mean of 260 μ , number of holes in the disk usually 3, varying from none to 6. Between these there are a very few delicate ones (Ludwig, pl. 18, fig. 11) with a disk about 100 μ in diameter, and a spire 150 μ high. Toward the anterior and posterior regions of the body the tables become very robust and are usually beset with two processes produced in opposite directions, lying transversely to the body axis (Ludwig, pl. 18, fig. 10). These may attain the length of 700 μ . Spindle-shaped bodies which are found only in the caudal appendage are very abundant; their length varies 330–710 μ , holes 3–4 in number. Anchors and rosettes almost wanting; the racket-shaped bodies measure 540–650 μ long. Phosphatic corpuscles are clustered in patches all over the body except caudal appendage.

Though Kœhler and Vaney have proved the variability of the relative length of tail and similarity in shape of spicules, there remains some doubt as to the identity of this species with *M. musculus*. The only point of distinction between the two species seems to me to lie in the different distribution of spicules. In the specimen before

me those smooth, spindle-shaped bodies are never present in general perisome.

Habitat.—From the Gulf of Panama to the Gulf of California (Ludwig, 1894; Clark, 1913); Flores and Banda Seas (Sluiter, 1901); Suruga Bay.

46. *MOLPADIA ANTARCTICA* (Théel).

Trochostoma antarcticum THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, p. 44, pl. 2, figs. 7a-e; *Blake* Holothurioidea, 1886, pp. 16, 17.—AUGUSTIN, *Japanische Seewalzen*, 1907, pp. 35-36, text-figs. 22a-c.

Molpadia antarctica CLARK, *The Apodous Holothurians*, 1907, pp. 32, 168.

Station 5074. One specimen.

The specimen, which is 33 mm. in length inclusive of a very short tail, agrees very well with Théel's specimens. Phosphatic corpuscles are entirely absent, while tablelike deposits are undergoing change of color, as Théel found in the *Blake* specimens. Number of holes in disk usually 6, but may vary from 3 to 10. Diameter of disk 120-250 μ , with a mean of 185 μ , height of spire 150 μ . There is found another kind of deposits, which are minute and have a solid spire ending in three hooks. Tables of caudal appendage are smaller, with a disk of 40-110 μ in diameter, and a very robust and spinose spire consisting of 3-5 pillars.

Habitat.—Chile (Théel, 1886; Clark, 1907); between Florida and Cuba (Théel, 1886); off Alexander Land, Antarctic (Héroüard, 1901); Okinose, Sagami Sea (Augustin, 1908); Suruga Bay.

47. *MOLPADIA DIOMEDIÆ* (Mitsukuri).

Ankyroderma diomedæ MITSUKURI, *Actinopodous Holothurioidea*, 1912, pp. 265-267, pl. 8, fig. 77, text-fig. 54.

Station 5073. One specimen.

Of the whole collection this was the only specimen which Professor Mitsukuri was able to examine and describe. I may here make some additional statements.

Color yellowish-brown all over. Deposits are abundant and well developed, so that the integument is quite rough to the touch. Racket-shaped bodies are 550-780 μ long with a straight, smooth handle. Usually 7 or 8 of them together form a rosette, but the number may vary from 6 to 10. Anchors measure 400-460 μ in length and are in most cases broken off. Each of the arms bears 4 teeth on the outer side. Base of the anchor is 70-90 μ in diameter and is perforated with 4 primary, 4 larger, and several minute peripheral holes. Tablelike bodies are very robust with a disk expanded in 2, 3, or 4, directions and perforated with numerous holes. Spire is tall, about 350 μ , consisting of 4, but rarely 3 or 5, pillars with more than 10 crossbeams and fine dentition along the outer side. Including the larger central

4, the number of holes varies 30–50, with a mean of 40. Mean diameter of disks 420μ , with a range of 270 – 550μ . In caudal appendage the disks are regularly spindle-shaped, with very minute holes and a low spire.

M. dissimilis Clark seems to present a close resemblance to the present species. But the tables and anchors are four-rayed in our species and three-rayed in *dissimilis*.

Habitat.—Suruga Bay (Mitsukuri, 1912).

Type.—Cat. 34161, U.S.N.M.

48. MOLPADIA CLARKI, new species.

Plate 9, figs. 14a–c.

Station 4983. Two specimens.

The more or less distorted body measures 43 mm. long including the caudal appendage which is 8–12 mm. Color gray all over, with a slight tinge of purple. Integument soft but rough from the presence of anchors. Tentacles 15, each with a pair of small digits. Deposits much resembling those of *M. roretzii* but larger and more irregular. Tables (pl. 9, figs. 14a, b) have disks of irregular contour, often excentric with regard to the primary cross. Mean diameter 200μ , ranging between 110 and 340μ , holes 7 or 8 in number, varying from 2 to 24. Spire about 160μ high, composed of 3 pillars, and armed with 9 or more teeth at the top and often some more on the sides. In the anterior region these tables are small and simple. Tables of the caudal appendage (fig. 14c) are elongated, measuring 240 – 450μ in length, with a spire about 100μ high. Racket-shaped bodies are about 715μ in average length, ranging between 460 and 840μ , similar in shape to those of *M. roretzii* but plumper and with smaller holes. A rosette is composed of 5 of these bodies in most cases, but the number may vary from 3 to 10. Anchors measure 480 – 520μ in length, with a base 80 – 105μ in diameter, and bearing on each arm 4, or sometimes 3 or 5, prominent teeth. Anal teeth forked at base, measuring 600μ by 300μ . Phosphatic corpuscles about 30 – 120μ in diameter. Radial segments of calcareous ring have a rather long posterior prolongation bifurcated at the end. Polian vesicle and stone canal single. Respiratory trees 2, the right one being twice as long as the other.

The present species differs from *M. productamensis* Clark in some minor points. In this Japanese species the bifurcation of posterior prolongations of calcareous ring is not very deep, spire of tables has fewer crossbeams, and elongated tables in caudal appendage are larger and more robust. It is my great pleasure to name this species for Dr. Hubert Lyman Clark, of the Museum of Comparative Zoology, Harvard College.

Habitat.—Off the coast of Shiribeshi, Hokkaido.

Type.—Cat. No. 34162, U.S.N.M.

49. *MOLPADIA INFESTA*, new species.

Plate 9, figs. 15a, b.

Station 4812. One specimen.

Body fusiform, 60 mm. long, including the caudal appendage, which is about 5 mm. in length and not distinctly set off from the rest of body. Color grayish-brown, integument rough to the touch. Tentacles 15 in number, each with a pair of minute digits. Deposits of perisome are tables only (pl. 9, fig. 15a). Disks averaging 250μ in diameter, with a range of $175\text{--}310\mu$, usually with 3 holes, often none, or in some cases with smaller peripheral ones, numbering up to 14 in all. Spire is made up of 3 pillars armed with some teeth on the top and sides, and connected with each other by 3 crossbeams, height ranging between 120 and 170μ . In the caudal appendage tables are modified into elongated plates without spire, but often with knobs (fig. 15b). Length of these plates varies $280\text{--}380\mu$, holes numbering from 4 to 20 or more. Phosphatic corpuscles are irregularly dispersed measuring in most cases $30\text{--}80\mu$ in diameter. Calcareous ring similar in form to that of *M. intermedia*. Polian vesicle and stone-canal single. Respiratory trees two, the right one much larger than the other.

The present species resembles *M. clarki* but differs from it in some points relating to deposits, from *M. intermedia* in shape of deposits of the tail, and from *M. andamanensis* (Walsh) in shape of tables in general perisome. The specimen is severely infested by a species of Gregarina encysted at several parts, such as radial muscles, mesenteries, intestinal blood vessels, etc.

Habitat.—North of Sado Island, Japan Sea.

Type.—Cat. No. 34163, U.S.N.M.

Genus CAUDINA Stimpson.

50. *CAUDINA LUDWIGI*, new species.

Plate 9, figs. 17a-c.

Station 5085. A fragment.

Only a posterior part is left, measuring 73 mm. long, 12 mm. in diameter at the thickest part, the posterior two-thirds 6 mm. in diameter throughout. Color dirty white, integument transversely wrinkled, stiff, and very rough to the touch. Deposits very abundant, overlapping one another, in two forms but not arranged in distinct layers. One form is spinose and tablelike (pl. 9, figs. 17a, b), with an angular disk perforated with 17-55 holes and a conical spire consisting of 3, rarely 4 or 5, pillars united together by 3 or 4 crossbeams. Diameter of the disk $270\text{--}410\mu$; height of spire $160\text{--}200\mu$. The other form, which is very sparsely found, is a smaller, spinose plate

with larger holes, measuring 220–280 μ in diameter (fig. 17c). No anal teeth and papillæ are found. No account concerning tentacles and viscera can be given for want of the anterior part of body.

The present species very much resembles *C. californica* Ludwig, but differs from it in having tables besides the spinose plates. I take much pleasure in dedicating this new species to the late Prof. Hubert Ludwig of the University of Bonn.

Habitat.—Sagami Sea.

Type.—Cat. No. 34164, U.S.N.M.

Family CUCUMARIIDÆ Ludwig.

Genus CUCUMARIA Blainville.

51. CUCUMARIA JAPONICA Semper.

Cucumaria japonica SEMPER, Holothurien, 1868, p. 236, pl. 31, fig. 5; pl. 33, fig. 7; pl. 34, fig. 10; pl. 38, figs. 5, 6, 8, 9, 12, 13; pl. 39, figs. 2, 3, 7, 18.—BRITTEN, Holothurien a. d. japan. u. ochotsk. Meere, 1907, pp. 133–135.—AUGUSTIN, Japanische Seewalzen, 1908, pp. 25–26, text-fig. 18.—EDWARDS, Four Species of Pacific Holothurians, 1910, pp. 603–604, pl. 19, figs. 15–16.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 242–246, pl. 8, figs. 67, 68, text-fig. 48.

Mororan. One specimen.

Station 5010. One specimen.

Unknown locality. One specimen.

The largest specimen is 145 mm. long, 85 mm. in transverse diameter. Besides the deposits already known there are found in the introvert massive, elongated plates with irregular ridges near the center, like those known in *C. frondosa* (Gunner).¹ Mean length of these bodies is 450 μ , range being 230–580 μ .

Habitat.—Japan (Semper, 1868); ?Moluccas (Sluiter, 1895); Aniwa Bay; Terpyeniya Bay; and Busse Bay, Sakhalin; Amur Bay; Askold Island; Chalezov Island; and Cape Nasimov (Britten, 1907); Trakaku Islands; Nemuro, Hokkaido; and Onagawa Bay, Ojika Peninsula (Augustin, 1908); Hakodate (Edwards, 1910; Mitsukuri, 1912); Ojika Peninsula; Atkeshi, Kushiro, Hokkaido (Mitsukuri, 1912); Mororan, Hokkaido.

52. CUCUMARIA MINIATA (Brandt).

Cladodactyla (Polyclados) miniata BRANDT, Prodrömus, 1835, p. 44.

Cucumaria miniata SELENKA, Beiträge zur Anatomie und Systematik der Holothurien, 1867, p. 350.—EDWARDS, Four Species of Pacific Holothurians, 1910, pp. 604–607, pl. 19, figs. 17–21.

Cucumaria albida SELENKA, Beiträge zur Anatomie und Systematik der Holothurien, 1867, p. 350, pl. 20, fig. 109.

Cucumaria japonica LAMPERT (not Semper), Seewalzen, 1885, p. 143.—CLARK, Zool. Anz., vol. 25, No. 677, 1902, pp. 562, 564.—EDWARDS, Albatross Holothurians, 1907, pp. 61–62.

Dockton, Puget Sound, Washington. Two specimens.

¹ See Edwards, Revision, vol. 1, 1910, pl. 13, fig. 19.

The larger specimen is in formalin, and measures 72 mm. long and 14 mm. in diameter. Except that the end plate of pedicels is always single, the specimens well answer to the description given by Edwards.

Habitat.—Pacific coast of North America.¹

53. *CUCUMARIA CALIFORNICA* Semper.

Cucumaria californica SEMPER, *Holothurien*, 1868, p. 235, pl. 39, fig. 16; pl. 40, fig. 10.—EDWARDS, *Four Species of Pacific Holothurians*, 1910, pp. 601–603, pl. 19, figs. 5–14.

Cucumaria frondosa EDWARDS, *Albatross Holothurians*, 1907, pp. 59–60.

Station 4777. One specimen.

Station 4778. One specimen.

Station 4779. One specimen.

Station 4784. One specimen.

Medni Island on fish line. One specimen.

The largest specimen, very strongly contracted, measures 135 mm. by 80 mm. The general body configuration is very like that of *C. japonica*, while *C. miniata* is distinguishable from both of them by its being markedly elongated.

Habitat.—From the North Pacific Ocean to the Galapagos.²

54. *CUCUMARIA CHRONHJELMI* Théel.

Cucumaria chronhjelmi THÉEL, *Challenger Holothurioidea*, pt. 2, 1886, p. 105.—

CLARK, *Echinoderms from Puget Sound*, 1901, p. 334, pl. 4, figs. 11–20.—

MITSUMURI, *Actinopodous Holothurioidea*, 1912, pp. 235–238, pl. 8, figs. 71–72, text-fig. 46.

Dockton, Puget Sound, Washington. Six specimens.

The largest specimen, with contracted introvert, measures 90 mm. in length and 30 mm. in diameter. In the introvert reticulated cups are slightly larger and more regular in shape than those in general perisome. The greater diameter averages 80 μ , with a range of 54–130 μ . There are, besides these, elongated plates, 350 μ long, with reticulated knobs.

Habitat.—Vancouver Island (Théel, 1886); Pacific Grove, California; and Puget Sound, Washington (Clark, 1901); Dock, Port Townsend, Washington (Edwards, 1907); Pacific coast of Japan from Hokkaido to Province Shima (Mitsukuri, 1912).

55. *CUCUMARIA VEGÆ* Théel.

Cucumaria vegæ THÉEL, *Challenger Holothurioidea*, pt. 2, 1886, p. 114.—CLARK, *Zool. Anz.*, vol. 25, No. 677, 1902, p. 563.—EDWARDS, *Albatross Holothurians*, 1907, p. 59.—MITSUMURI, *Actinopodous Holothurioidea*, 1912, pp. 255–257, pl. 1, fig. 9.

Dutch Harbor, Unalaska Island. Eight specimens.

Unalaska. Twenty-two specimens.

¹ See Edwards, 1910, p. 607.

² Idem, pp. 602–603.

Nazan Bay, Atka Island. Eleven specimens.

Agattu Island. Eight specimens.

Nikolski, Umnak Island. Twenty-one specimens.

Milne Bay, Simushir Island, Kuriles. Five specimens.

The largest specimen is 75 mm. long and 14 mm. wide. The spectacle-like deposits, with 0–6 holes in each half, measure 50–220 μ in length, with a mean of 120 μ . Those modified into perforated plates are more frequently found in young than in older ones, and may measure 200 μ in diameter with holes numbering up to 40. End-plates of pedicels are rudimentary or utterly wanting, measuring 62–135 μ in diameter. The introvert seems to be destitute of deposits, except in pedicels.

Habitat.—Bering Island (Théel, 1886); St. Paul, Pribilof Islands; and Copper Island (Clark, 1902); Sitka (Clark, 1902); Shakan Beach, southeast Alaska (Edwards, 1907); Hokkaido (Mitsukuri, 1912).

56. CUCUMARIA CALCIGERA (Stimpson).

Pentacta calcigera STIMPSON, Proc. Boston Soc. Nat. Hist., vol. 4, 1851, p. 67.

Cucumaria calcigera SELENKA, Beiträge zur Anatomie und Systematik der Holothurien, 1867, p. 351.—DUNCAN and SLADEN, A Memoir on the Echinodermata, 1881, pp. 5–8, pl. 1, figs. 3–8.—BELL, Journ. Roy. Micr. Soc., ser. 2, vol. 3, 1883, p. 481, pl. 8, figs. 2, 2a.—LUDWIG, Echinodermen des Beringsmeeres, 1886, pp. 277–279, pl. 6, figs. 1–5; Arktische und subarktische Holothurien, 1900, pp. 146–147.—KALISCHEWSKIJ, Echinodermenfauna d. sibir. Eismeeres, 1907, p. 4.—BRITTEN, Holothurien a. d. japan. u. ochotsk. Meere, 1907, pp. 136–137.—EDWARDS, Albatross Holothurians, 1907, pp. 54–59, text-figs. 5–11.

Station 4903. One specimen.

Station 5000. One specimen.

Station 5001. One specimen.

Station 5002. One specimen.

Station 5003. Three specimens.

Station 5004. Five specimens.

The specimen from station 4903 differs from the rest in having the pedicels all retracted and the introvert extended, and in having spicules markedly smaller than in others. It is a wonder that this arctic species occurs in such warm regions.

Habitat.—To the localities given by Ludwig (1900) and Edwards (1907) the following may be added: Fox Harbor, St. Louis Sound, Newfoundland (Bush, 1884); Sabacheyago, Murman coast (Derjugin, 1906); south of Bennett Islands (Kalischewskij, 1907); west coast of Sakhalin (Britten, 1907). From Kalischewskij's report it can scarcely be doubted now that this species is completely circumpolar in distribution.

57. *CUCUMARIA GLACIALIS* Ljungman.

Cucumaria minuta STUXBERG (not Fabricius), Öfv. af kongl. Vet. Akad. Förhandl., 1878, p. 27.

Cucumaria glacialis LJUNGMAN, Öfv. af kongl. Vet. Akad. Förhandl., 1879, pp. 128-129.—MORTENSEN, Zeitschr. f. wiss. Zool., vol. 57, 1894, pp. 704-732, pls. 31-32.—LUDWIG, Arktische und subarktische Holothurien, 1900, pp. 144-145.—KALISCHEWSKIJ, Echinodermenfauna d. sibir. Eismeer, 1907, pp. 3-4.—BRITTEN, Holothurien a. d. japan. u. ochotsk. Meere, 1907, pp. 137-138.

Station 4795. One specimen.

The specimen is a male, measuring 40 mm. in length in contracted state. No account need be added to the excellent descriptions given by Mortensen and Britten.

Habitat.—Besides the localities given by Ludwig (1900) the following may be added: Stor-Fjord, Spitzbergen; and vicinity of Novaja-Semlja (Michailowskij, 1902, 1904); Nordenskjöld Sea; and north of New Siberia Islands (Kalischewskij, 1907); Ochotsk and Japan Seas (Britten, 1907); east coast of Kamchatka.

58. *CUCUMARIA CAPENSIS* Théel.

Cucumaria capensis THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 62-64 pl. 5, fig. 2.—LUDWIG, Alte und neue Holothurienarten, 1887, p. 1236.—SLUITER, *Siboga* Holothurien, 1901, p. 80, pl. 7, fig. 4.

Cucumaria tegulata AUGUSTIN, *Japanische Seewalzen*, 1908, pp. 24-25, text-figs. 16, 17.

Cucumaria capensis, var. *parva* MITSUKURI, *Actinobodous* Holothurioidea, 1912, pp. 233-235, pl. 8, fig. 74, text-fig. 45.

Station 4900. Four specimens.

Station 4903. One specimen.

The largest specimen is only 10 mm. long. The Japanese specimens reported on under the above-mentioned names by Augustin and Mitsukuri are doubtless identical with Théel's. As Ludwig had only a small specimen, 15 mm. long, under observation, I can not follow Mitsukuri in separating the Japanese form as a variety.

Habitat.—Off Cape of Good Hope (Théel, 1886); Cape Town (Ludwig, 1887); Moro Strait; southwest of Timor; and Sulu Archipelago (Sluiter, 1901); Uruga Channel (Augustin, 1908); Jogashima and Moroiso, Misaki (Mitsukuri, 1912); off Goto Islands, west of Kyushu.

59. *CUCUMARIA IJIMAI*, new species.

Plate 10, figs. 18a-c.

Station 4784. Seventy-one specimens.

Body ovoid, measuring 31 mm. long and 14 mm. broad, with mouth and anus turned dorsad. Color white all over, with a light cream tinge; integument thin and semitranslucent, smooth to the touch. Tentacles 10, very small and of uniform size. Pedicels in a double

row along the odd ambulacrum, in a single row in each ventrolateral ambulacrum. In the largest specimen there are 34 pedicels in the odd ambulacrum, 20 and 22 respectively in the paired ambulacra. In each dorsal ambulacrum there are at most 7 knoblike pedicels in a single row; a few similar knobs are present at the anterior ends of the ventral ambulacra. In young specimens the dorsal ambulacra are almost destitute of appendages. Interambulacra are completely naked. Deposits are of a characteristic form, being delicate, smooth rods with both ends branched once or twice dichotomously (pl. 10, figs. 18*a*, *c*). Their length varies 45–180 μ , with a mean of 94 μ . These are by no means crowded but are quite sparse, especially in dorsum. Between them there are deposits of another form, simple rods with a joint at the middle (fig. 18*b*), with the average length of 63 μ , varying 25–107 μ . Probably these are early stages of the above-mentioned branched bodies. Single deposits heavy at the posterior end but no anal teeth can be found, those of introvert not distinguishable from those of general perisome. In pedicels and papillæ deposits are numerous, much branched, sometimes nearly forming a perforated plate. End plates of pedicels well developed, measuring 405–670 μ in diameter. Supporting bodies of tentacles are irregular rods and large, curved, perforated plates. Calcareous ring quite weakly calcified, without posterior prolongations. Retractors thin and threadlike, inserted to body wall about one-fourth the body length from the anterior end. Polian vesicle and stone-canal single. Respiratory trees two, rudimentary, measuring only 6 mm. in length, with a few finger-shaped branches. Genital tubes unbranched, about 20 mm. long and 1 mm. thick, in two tufts of a few tubes each. Ovarian ova measure 0.5–0.55 mm. in diameter. Genital papilla situated between the mid-dorsal tentacles.

In all females above 10 mm. in length, a pair of brood pouches are present in the ventral interambulacra, about 3–4 mm. behind the tentacular crown. When filled with young these pouches occupy almost the whole body cavity; thus, in a specimen 16 mm. long, the right pouch measured 11 mm. by 7 mm. and the left one 8 mm. by 6.5 mm. The wall of the pouch is very thin and transparent, and without deposits. So far as my examinations extended, the young were all in the same stage of development. In the specimen just referred to, there were 12 young in the right pouch and 7 in the other. In an extreme case 16 young were contained in a single pouch.

The size of the young observed by me varied in length between 2 and 7 mm. with a mean of 5 mm., and in diameter between 1 and 4 mm. with a mean of 3 mm. Some of their characteristics may be given. Body wall very thin and transparent, so that the internal organs are easily visible from outside. Around the mouth, which is already open, there are 10 quite short tentacles with a few branches.

Six or seven pedicels are present in each ventral ambulacrum, none observed so far in the bivium. Deposits frequently present at the posterior end of body and in pedicels, but very rare in other parts. They are simple rods and may have both ends forked. The wall of the stone-canal and its openings with quite a mass of simple rods. The internal organs to be noted are: 10 segments of the calcareous ring formed as a loose network; 5 longitudinal muscles with slender retractors; a single Polian vesicle; a stone-canal inserted to body wall; a pair of rudimentary genital organs attached to dorsal mesentery; and the alimentary canal in the form of a somewhat drawn-out spiral, with a pair of rudimentary respiratory trees at the beginning of the cloaca. At the point where the stone-canal reaches the body wall, the canal is dilated into a flat cavity extending posteriorly and branched like roots, with external opening at each end.

Of the known species of *Cucumaria*, *C. abyssorum* Théel perhaps stands nearest to this species, but it lacks the brood pouches and the deposits are very different. I take great pleasure in naming this most interesting form for Prof. Isao Ijima, of the Science College, Tokyo Imperial University.

Habitat.—Aleutian Islands.

Type.—Cat. No. 34165, U.S.N.M.

60. CUCUMARIA LAMPERTI, new species.

Plate 10, figs. 19a-b.

Station 4778. Four specimens.

Station 4779. One specimen.

Station 4784. Forty-six specimens and twenty-nine young born after capture.

Station 4786. One specimen.

Station 4792. One specimen.

Body ovoid, 34 mm. long. and 14 mm. broad, with both ends turned dorsad. Color white or tinged with light yellow, integument stiff and rough to the touch from the presence of abundant deposits. Tentacles 10, very short, midventral pair much smaller than the rest. Pedicels confined to the ambulacra, in double rows in trivium, in one case 44 in the midventral, 37 and 38 in each ventrolateral ambulacrum. In younger specimens the ventrolateral ambulacra had only single rows of pedicels. In the bivium they are generally reduced and papilla-like, numbering 5 to 10 in each ambulacrum. But in some individuals there is a complete double row of well-developed pedicels, numbering 30 in each. Deposits in the form of thick, knobbed plates of various sizes (pl. 10, fig. 19a) are very abundant, especially in ventral perisome. The small ones are smooth, button-shaped and bear at one end some spines (fig. 19b), which become obscured in very large ones. These plates lie imbricated, with the spinous end

obliquely overlapping the neighboring one. Their greater diameters range from 20 to 660μ ; holes 4 to over 60 in number. Deposits in the introvert are scattered, knobbed plates usually oblong in outline, destitute of spines. These range $95\text{--}220\mu$ in diameter, holes varying in number from one to above 10. Anal teeth 5, well developed. Pedicels are supported with rather delicate, smooth plates and an end-plate, well developed in ventral pedicels but quite rudimentary in those of dorsum. Supporting bodies of tentacles are either rod-like or plate-like, knobbed or smooth. Calcareous ring tolerably well developed, without posterior prolongations. Retractors inserted to body-wall a little anterior to the middle of body. Polian vesicle and stone-canal single. Respiratory trees two, measuring at most 5 mm. in length, with a few branches. Genital tubes unbranched, in 2 tufts of a few tubes each. Ovarian ova measure about 0.8 mm. in diameter. Genital papilla is found between the middorsal pair of tentacles.

In female specimens a pair of brood pouches are found on the ventral side, a little anterior to the middle of body. The pouch even when filled with young is not spacious, measuring at most only 4.5 mm. in diameter. The wall of the pouch is very thin and contains no deposits. In a specimen 16 mm. long, there were 14 young in the right pouch, all polyhedral in shape from mutual pressure. The 29 young contained in the same bottle were probably born after the capture of their mother, and are in the same stage of development as those contained in the pouch but are quite plump and oval in shape.

The lengths of the young range 1.8–3.2 mm. Body wall is very thick, of a cream color and opaque. Tentacles 10, slightly branched at end, midventral pair smaller than the others. Mouth is not yet open, a massive wall forming a low prominence over it. Pedicels present only in trivium, numbering 5–7 in each ambulacrum. In perisome are scattered X-shaped plates with dichotomously branched arms, like those known to occur in the young of *C. parva* Ludwig.¹ In pedicels are found X-shaped deposits similar to, but markedly smaller than, those of body surface. End plate single, sometimes with several holes. Calcareous ring in the form of a network; retractors and longitudinal muscles well developed. Polian vesicle single, stone-canal attached to the body wall but not opening externally (?). Alimentary canal coiled, with thick muscular wall. Yolk granules are abundantly found in body wall, body cavity, alimentary canal, and water-vascular system.

The present species is very closely allied to the antarctic *C. lævigata* (Verrill), while the peculiarities observed in the young agree very well with those known for *C. glacialis* as reported by Mortensen, who, however, found three stages contained in a single pouch. The

¹ See Ludwig, Hamburger Magalhænsische Sammelreise, 1898, pl. 1, fig. 16.

species is named for Prof. Kurt Lampert of Stuttgart, with reference to his first discovery of a cucumarid with brood-pouches.

Habitat.—Aleutian Islands and vicinity of Commander Islands.

Type.—Cat. No. 34166, U.S.N.M.

61. CUCUMARIA SPINOSA, new species.

Plate 10, figs. 20a-c.

Station 5043. One specimen.

Station 5046 or 5047. Four specimens.

Station 5053. One specimen.

Body fusiform and strongly curved, with a long tapering posterior prolongation, as in *C. calcigera*. The largest specimen is 68 mm. long and 10 mm. across. Color white, integument thin and stiff, rough to the touch. Tentacles strongly retracted together with introvert, ventral two being smaller than the rest. Pedicels knob-like, arranged in an irregular zigzag row in each ambulacrum; above 30 pedicels in a row in the bivium, above 50 in the trivium. Inter-ambulacra naked. Anal papillæ five. Deposits of perisome are elongated oval buttons, thickest at the middle, with a tail-like process at the broader end (pl. 10, figs. 20a, b). There are 2, seldom 3, rows of holes, usually 8 or 9 in number, but varying from 4 to 25. The tail-like process has a small hole and a pair of short spines at its end. As may be seen from comparison with an early stage (fig. 20c), these deposits are developed along an axis making an angle of about 30° with that of the primary cross. Length varies 125–400 μ , thickness about 35 μ . They lie thickly imbricated, with the tail-like process turned backward and obliquely protruding from skin. In the introvert deposits are thinly scattered delicate plates. Anal teeth quite rudimentary. In pedicels are found bent, irregular, rod-like plates, and an imperfect end-plate represented by delicate, branched rods. Supporting rods of tentacles are irregularly perforated. Calcareous ring consists of ten high, narrow segments, radials about 3 mm. long, deeply notched posteriorly but without prolongations. Retractors slender, inserted to body wall at about one-third the length of contracted body. Polian vesicle single, stone-canal also single with a large fungiform madreporite. Respiratory trees 4, 2 on each side, over 20 mm. in length, opening into the anterior end of the cloaca, which is 30 mm. long. Genital tubes unbranched.

The present species resembles *C. koræensis* Östergren in many respects, but differs in shape of deposits and anal teeth. The characteristic spicules remind one of those of *C. fallax* Ludwig as figured by Edwards.¹

Habitat.—Off Hitaka, Hokkaido; off Ojika Peninsula; Suruga Bay.

Type.—Cat. No. 34167, U.S.N.M.

¹ Four species of Pacific Holothurians, 1910, pl. 19, fig. 22.

62. CUCUMARIA SLUITERI, new species.

Plate 10, figs. 21a, b.

Station 5079. One specimen of doubtful specific identity.

Station 5082 or 5083. Two specimens.

Body elongated oval, 11 mm. in length and 5 mm. in diameter, with mouth and anus terminal. Color gray, integument thin and translucent. Tentacles 10, all equal in size. Pedicels are arranged in a row along each ambulacrum, each row consisting of 10 pedicels in trivium and of 3 or 4 in bivium. Scattered in dorsal perisome are found X-shaped, tablelike deposits (pl. 10, figs. 21a, b). The arms may number up to 7, and the ends are dilated and perforated. Spire is solid, situated on one of the arms near its base, and bears irregular teeth. Diameter of base ranges $210\text{--}380\mu$, with a mean of 300μ ; height of spire commonly 150μ . Near the introvert these tables become plumper, and the spire is replaced by an arm arising obliquely from the basal plane, exactly as in *C. abyssorum*.¹ The introvert as well as the greater part of ventrum are devoid of spicules. Pedicels are supported with bent rods, 300μ long, with a thick branch given out from the middle. End plate single, rather weakly developed. Supporting rods of tentacles are similar to those of pedicels. No anal teeth can be made out. Calcareous ring fragile, without posterior prolongations. Retractors very slender, inserted to body wall at one-third of body length from the anterior end. Polian vesicle single. Genital tubes thick and short, unbranched.

This interesting species stands very close to *C. abyssorum*, in which, however, those delicate X-shaped tables are not present. *C. nocturna* Sluiter is also a close ally to this species, but differs in the tentacles being not all of uniform size and the dorsal pedicels being long and stiff, and in some characters of deposits. I take pleasure in naming this species for Prof. C. Ph. Sluiter, of the University of Amsterdam.

With much hesitation I refer a specimen from station 5079 to this species. All calcareous bodies are dissolved, only leaving rods $75\text{--}130\mu$ long, with bifurcated ends. Each of these bodies supports a conical papilla, $40\text{--}160\mu$ long, scattered all over the body. Probably these are the remnants of the spirés of those X-shaped tables.

Habitat.—South of Totomi, Honshu.

Type.—Cat. No. 34168, U.S.N.M.

63. CUCUMARIA CONSTRICTA, new species.

Plate 10, figs. 22a, b.

Station 4880. One specimen.

Station 4903. One specimen.

Body strongly curved, with the large introvert protruded from the constricted anterior end. Length about 23 mm., diameter about

¹ See Théel, *Challenger Holothurioidea*, pt. 2, 1886, p. 67, pl. 4, fig. 6b.

6 mm. Color white, introvert and tentacles tinged with brown; integument stiff, rough to the touch. Tentacles 10, midventral pair being smaller than the others. Pedicels nonretractile, confined to ambulacra, along each of which they form a double row, of about 60 pedicels in bivium, and 70 in trivium. Table like deposits (pl. 10, figs. 22a, b) are very abundant in general perisome. Disk is elongated, with 3–10 holes and wavy margin, 73–240 μ in diameter. Those lying externally measure 160 μ in average diameter, being smaller than those of the inner, which are about 200 μ on an average. Spire, 50–60 μ high, consisting of two pillars united by a crossbeam, and armed with 6–8 teeth at the top. There are found between these bodies larger smooth plates without spire. In the introvert are scattered very delicate tables with oval disk and zigzag margin, 60–240 μ in diameter, with 10–40 holes and a spire 12 μ high. No anal teeth are found. Pedicels are supported with bent, modified tables with narrowed disk, measuring 120–190 μ long, with 4 holes at the middle and 1–3 holes at each end. Spire about 33 μ high, consisting of two pillars united at the top, armed with three teeth. Supporting rods of tentacles are very irregular and spinous. End plate well developed, 260 μ in diameter, often wheel-like as in *Thyone venusta* Selenka.¹ Calcareous ring massive, with long posterior radial prolongations.

Polian vesicle single; stone-canal also single, with a large, kidney-shaped madreporite. Respiratory trees two, genital tubes unbranched.

From *C. perditia* K  hler and Vaney the present species differs only in the absence of pedicels from the interambulacra. This species also resembles *C. calcigera* in shape of tables, calcareous ring, and madreporite. But the considerable size of end plate, shape of tables in the introvert, absence of the deeper layer of elongated plates, etc., distinguish it from all others.

Habitat.—Genkai Sea, north of Kyushu; off Goto Islands, west of Kyushu.

Type.—Cat. No. 34169, U.S.N.M.

64. CUCUMARIA, species (juv.).

Station 5087. Four specimens.

Body cylindrical, with truncate anterior and dorsally curved posterior end. The largest specimen is only 11.5 mm. long and 5.5 mm. in diameter. Color brownish-white, integument stiff and rough. Tentacles 10, 2 ventral markedly smaller than the others. Pedicels not retracted; arranged in a single row in each ambulacrum, very few in bivium. Deposits in the form of smooth, elliptic plates with wavy margin and slightly spinous ends, 170–320 μ in length, with 4–17 holes. Introvert, tentacles, and pedicels with rods which are often branched,

¹ See Selenka, Nachtrag, 1868, pl. 8, fig. 12.

and have some holes in the extremities, measuring $240\text{--}440\mu$ in length. End plate weakly developed, only represented by branched rods. Anal teeth well developed. Calcareous ring without posterior prolongations. Polian vesicle and stone-canal single. Respiratory trees 2, with a few branches. Genital tubes unbranched.

I thought at first that these specimens were the young of *C. echinata* v. Marenzeller, which is quite common in Sagami Sea, since in a young stage the deposits of its perisome do not show the characteristic spine and knobs. But in the present species the plates are more numerous than in *C. echinata* of corresponding age, the spinous plates are absent from pedicels, and the end plates are less perfectly formed. From *C. capensis* this species seems to differ in deposits.

Habitat.—Sagami Sea.

65. *CUCUMARIA MOSAICA* Kœhler and Vaney.

Cucumaria mosaica KœHLER and VANEY, Description d'Holothuries nouvelles, 1910, pp. 98–99, pl. 2, figs. 1–5.

Station 5074. One specimen.

Body about 21 mm. long, 5 mm. in diameter. Tentacles 10, midventral pair very much smaller than the rest. The lenticular deposits composed each of 3 or more layers of knobbed plates connected by means of trabeculæ measure $180\text{--}450\mu$ in diameter and 80μ in thickness. Mingled with these large plates are found a few spinous tables with two-pillared spire. Diameter of disk $63\text{--}130\mu$, height of spire $25\text{--}35\mu$. Between these two sorts there are all stages of transitional forms. In the introvert elliptic plates, $80\text{--}120\mu$ long, with more or less rudimentary spire are very abundant. There are found, besides these, complicated rosettes near base of tentacles. In pedicels a weakly developed end plate without any regular, rounded margin is present, besides the arched, modified tables described from the original specimen. Supporting rods of tentacles are delicate or elegant rods, with a pair of large holes at the middle and a second of minute ones. The large lenticular bodies are totally absent near the anus, while the tablelike ones are here abundant. Anus guarded with 5 simple perforated plates. Polian vesicle single; stone-canal also single, with a two-lobed, minute madreporite. Retractors weakly developed, inserted to body wall at one-third the body length. Genital tubes unbranched in two tufts. At the tip of each tube is found a needle-like spicule, $250\text{--}650\mu$ long, with two minute holes near the middle. Respiratory trees, 2, the right branch being very long.

Kœhler and Vaney had only one eviscerated specimen, with which the specimen before me agrees in every essential character; only the lenticular bodies are more robust and knobbed, and the smaller plates are provided with a spire.

Habitat.—Persian Gulf (Kœhler and Vaney, 1910); Suruga Bay.

66. CUCUMARIA GLOBOSA, new species.

Station 4891. One specimen.

Body sphaerical, with mouth and anus situated on the dorsal side, not forming any sort of conical siphon, being contracted and scarcely projecting beyond the general body surface. Length, 9.5 mm.; height, 8.5 mm. Color dirty white, integument stiffened by scalelike plates. Tentacles 10, of which midventral pair probably smaller. Pedicels very minute, arranged in 2 rows in each ambulacrum, though very sparse in dorsum where the zonal arrangement is also obscured. The large scalelike plates of body wall are rounded, measuring 0.9–1.5 mm. in diameter, with serrated margin. They resemble in structure very much those of *Sphaerothuria*, only differing in that the spine is very much reduced or totally absent. Some of them have a round hole or a marginal incision, through which a pedicel passes out. The introvert contains oblong, perforated plates, slightly knobbed, measuring 140–180 μ long. Tentacles are supported with curved plates or rods, slightly knobbed, 200–330 μ in length. Supporting rods of pedicels are irregularly branched or perforated, sometimes knobbed, measuring 73–120 μ in length. End plate 80–100 μ in diameter. Calcareous ring consists of 10 segments, without posterior prolongations. Respiratory trees small, with a few branches. Genital tubes unbranched. Further details of internal organization can not be given owing to the badly injured condition of the specimen.

In spite of its resemblance to *Sphaerothuria bitentaculata* Ludwig and *Ypsilothuria talismani* Perrier in external features, this species differs in having 10 ramified tentacles, none of which are especially larger. *Psolidium sphaericum* Sluiter is very closely allied to the present species, but its scalelike deposits are smaller in ventrum than in dorsum and have each 3–8 spines.

Habitat.—Off Goto Islands, west of Kyushu.

Type.—Cat. No. 34170, U.S.N.M.

Genus SPHÆROTHURIA Ludwig.

67. SPHÆROTHURIA BITENTACULATA Ludwig.

Sphaerothuria bitentaculata LUDWIG, Bull. Mus. Comp. Zool., Harvard Coll., vol. 24, No. 4, 1893, pp. 112–113; *Albatross* Holothurioidea, 1894, pp. 141–155, pl. 12, figs. 16–17; pl. 14, figs. 5–14.—MITSUKURI, Annot. Zool. Japon., vol. 1, pt. 4, 1897, p. 149.

Ypsilothuria bitentaculata KÖHLER and VANEY, Les Holothuries de mer profonde, 1905, pp. 87–88.

Station 4906. One specimen.

Station 4913. One specimen.

Station 5054. Twenty-one specimens.

Station 5055. One specimen.

Station 5057. Six specimens.

Station 5088. Nine specimens.

Station 5093. Ten specimens.

The characteristic spines borne by the scalelike plates measure at most 1.02 mm. in length, commonly 0.5–0.7 mm., and 0.3 mm. in diameter. As can be seen in those broken near the base, the spine is composed of a bundle of several pillars, connected with each adjoining one by slender crossbeams arranged in concentric circles.

I take the genus to be characterized by the presence of 8 tentacles, regardless of their shape and relative size. According to this definition the name *Ypsilothuria* is not synonymous with *Sphærothuria*. That genus, as represented by *Y. talismani* Perrier, seems to be referable to the comprehensive genus *Cucumaria*, through such transitional forms as *Echinocucumis typica* Sars, *Psolidium sphæricum* Sluiter, etc.

Habitat.—Pacific coast of tropical America, from Cape San Francisco and Galapagos Islands to Lower California (Ludwig, 1894; Clark, 1913); Celebes, Moluccas, and Sunda Islands (Sluiter, 1901); Laccadives, Ceylon, and Andaman Islands (Kœhler, 1898; Kœhler and Vaney, 1905); Uruga Channel and Sagami Bay (Mitsukuri, 1897; Augustin, 1908); off Koshiki Islands, west of Kyushu; Suruga Bay. While in the tropical seas the bathymetrical range of this species is very considerable, being from 131 fathoms (India) to 2,232 fathoms (tropical America), in the temperate regions, such as Lower California and Japan, the animal lives in depths not exceeding 400 fathoms.

Genus COLOCHIRUS Troschel.

68. COLOCHIRUS INORNATUS v. Marenzeller.

Colochirus inornatus v. MARENZELLER, Neue Holothurien von Japan und China, 1881, pp. 130–132, pl. 5, figs. 7, 7a.—THÉEL, *Challenger* Holothurioidea, pt. 2, 1886, pp. 77–78, 120, pl. 6, fig. 8.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 221–224, pl. 8, fig. 73, text-fig. 40.

Station 4875. One specimen.

The specimen, measuring 19 mm. in length, 10 mm. in width, and 5 mm. in thickness, agrees well with the previous descriptions. The flat cups lying in superficial layer of perisome are 40–76 μ in diameter, being much smaller than those described by v. Marenzeller and Théel.

Habitat.—Japan (v. Marenzeller, 1881; Théel, 1886); Mergui Archipelago (Pearson, 1910); Tokyo Bay (Mitsukuri, 1912); north of Kyushu.

69. COLOCHIRUS DOLIOLUM (Pallas).

Actinia doliolum PALLAS, *Miscellanea zoologica*, 1766, p. 152, pl. 11, figs. 10–12.

Colochirus doliolum v. MARENZELLER, *Kritik adriatischer Holothurien*, 1874, pp. 303–304.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 218–221, pl. 1, figs. 10–11.

Colochirus australis LUDWIG, *Beiträge zur Kenntniss der Holothurien*, 1874, pp. 12–13, pl. 6, figs. 15a–c.

- Colochirus minutus* LUDWIG, Beiträge zur Kenntniss der Holothurien, 1874, p. 13, pl. 6, figs. 16a-c.
Colochirus armatus v. MARENZELLER, Neue Holothurien von Japan und China, 1881, pp. 132-134, pl. 5, figs. 8, 8Aa, b.
Colochirus australis, var. *armatus* LUDWIG, Holothurien des Kieler Museums, 1883, p. 161.—AUGUSTIN, Japanische Seewalzen, 1908, p. 29.
Colochirus pygmaeus THÉEL, Challenger Holothurioidea, pt. 2, 1886, p. 83, pl. 4, fig. 9.

Station 4895. One specimen.

Station 4935. One specimen.

Habitat.—Cape of Good Hope (Pallas, 1766); Angra Pequena (Ludwig, 1887); Cape Three Points (Clark, 1909). Triest (Sars, 1857); Quarnero (Grube, 1840); Lesina, Lissa (Heller, 1868); Cetta and Nice (Selenka, 1867). Bahia (Théel, 1886). Bowen and Sydney (Ludwig, 1874); Port Molle and Port Jackson (Bell, 1884; Théel, 1886); New South Wales and West Australia (Lampert, 1885). Dampier Island (Lampert, 1889); Billiton (Sluiter, 1887); Amboina (Ludwig, 1888; Sluiter, 1894); Sarassa Island; Molo Strait; Salawatti; Jedan Island (Sluiter, 1901). Ceylon (Pearson, 1903); Tor, coast of Sinai (Helfer, 1912). Japan (v. Marenzeller, 1881); Tokyo Bay (Augustin, 1908; Mitsukuri, 1912); Misaki; Yokohama; Shimoda; Niishima; Ago Bay; Kagoshima; Hokkaido (Mitsukuri, 1912); off Goto Islands, west of Kyushu; off Cape Sata, South of Kyushu.

Genus THYONE Oken.

70. THYONE MULTIPES Augustin.

Thyone multipes AUGUSTIN, Japanische Seewalzen, 1908, pp. 27-28, pl. 2, fig. 2, text-fig. 19.

Station 5055. Seven specimens.

Station 5057. Three specimens.

Station 5094. A pharyngeal mass with tentacles.

The largest specimen measures 28 mm. in length and 10 mm. in diameter. Deposits in general perisome are so sparse as to be easily overlooked. These are delicate table-like buttons with lozenge-shaped disk and two-pillared spire. The disk measures 33-85 μ in diameter, averaging 68 μ , with 4-13, but commonly 6 or 7 holes. Spire about 25 μ high, with the pillars connected by a crossbeam, and with 4-8 short teeth at the top. Towards the anal region the tables become smaller but have more holes. In the introvert the tables are larger and more robust, measuring 76-125 μ in diameter, with holes numbering up to 17, and the spire is 35-50 μ high. Very few complicated rosettes are also found in this region. Besides the 5 latticed anal teeth there are found several large round plates, 0.1-0.14 mm. in diameter, and with numerous holes, radially arranged around the anus. Pedicels with a well developed end-plate with the mean diameter of 96 μ (80-113 μ), and perforated with numerous irregular

holes which are larger towards the periphery; no other supporting bodies are present. Stone-canal not very short, as stated by Augustin, measuring 5 mm. in length, with kidney-shaped madreporite.

Both *Th. venusta* Selenka and *Th. villosa* Semper are very closely allied to the present species. It would not be surprising if later examinations should prove these forms to be one and the same species.

Habitat.—Uraga Channel and Sagami Bay (Augustin, 1908); Suruga Bay.

71. *THYONE PUNCTATA*, new species.

Station 4936. One specimen.

Body more or less quadrangular, with both anterior and posterior ends bent dorsad. Length, 28 mm.; diameter, 6 mm. Color whitish, punctate with brownish pedicels, tentacles dark gray. Integument thick and stiff, rough to the touch, except on the well-marked introvert, which is quite soft. Tentacles 10, of which the 2 ventral are very small. Pedicels minute and retractile, uniformly scattered all over the body except in the posterior three-fourths of the ventrum, where they are confined to the 3 ambulacra, forming dense double rows. Introvert free from pedicels. The integument is stiffened with thickly crowded buttons similar in form to those found in *Th. similis* Ludwig.¹ Length of the disk ranges 135–210 μ , averaging about 165 μ . In the deeper parts are found larger ones with the diameter of 260 μ and with over 10 holes. In the introvert these are modified into smaller knobbed plates, 90–180 μ in diameter, with 5–16 holes. Pedicels are supported by bent modified tables, 140 μ long, with 4 holes at the middle and 1 at each dilated end. Supporting rods of tentacles are smooth, with several holes at each end. Anal teeth present. Calcareous ring well developed, with long posterior prolongations. Polian vesicle single. Respiratory trees two. Genital tubes unbranched.

From *Th. sacellus* (Selenka) which is also known from the coasts of Kyushu, the present species differs in size and shape of deposits and in the number of Polian vesicles. *Th. belli* and *Th. similis*, both described by Ludwig, are very close to the present species, especially the former in distribution of pedicels. But greater size of the button-shaped deposits distinguishes above all the new species.

Habitat.—Off Cape Sata, south of Kyushu.

Type.—Cat. No. 34171, U.S.N.M.

72. *THYONE PARVA*, new species.

Plate 10, fig. 23.

Station 5046 or 5047. One specimen.

Body plump, spindle-shaped, 9 mm. long and 5 mm. thick, with mouth and anus turned dorsad, more or less resembling *Sphærothuria*.

¹ See Ludwig, Vettor Pisani Holothurien, 1887, pl. 2, figs. 7A', A''.

Color white, integument rather soft, slightly rough to the touch. Pedicels densely distributed all over, especially numerous on ventrum, without any serial arrangement except in anal region. Anus is surrounded by 5 anal papillæ. Tentacles 10, midventral pair slightly smaller than the others. Perforated plates of various sizes forming a thick layer in general perisome. Those situated most superficially (pl. 10, fig. 23) are small and rod-like, usually with a hole at each end, and vary $85\text{--}145\mu$ in length, averaging 120μ . In the deeper part are found larger, smooth plates, $200\text{--}400\mu$ in diameter, with 15–20 or more holes. Pedicels often passing through a large hole in these plates. There are found all transitional forms between these two sorts of deposits. In the introvert are found scattered, elongated plates of various sizes, with larger holes. Supporting rods of tentacles irregular in form, with minute holes. In pedicels also similar perforated rods, $90\text{--}210\mu$ long, are present. End plate well developed in ventral pedicels, measuring $110\text{--}150\mu$ in diameter, rudimentary in dorsal pedicels, being only $60\text{--}90\mu$. Calcareous ring well developed but devoid of posterior prolongations. Retractors are inserted to body-wall a little anterior to the middle of body length. Polian vesicle and stone-canal single. Genital tubes not branched, few in number. Respiratory trees two.

Th. spectabilis Ludwig differs from the present species in that the rod-like deposits are thinly scattered and never give rise to perforated plates. *Th. articulata* Vaney also has similar deposits but differs in having long posterior prolongations in the calcareous ring. The species also resembles *Th. unisemita* (Stimpson), but differs in the uniform distribution of the ventral pedicels and in the presence of end plates.

Habitat.—Off Ojika Peninsula, Honshu.

Type.—Cat. No. 34172, U.S.N.M.

73. *THYONE BICORNIS*, new species.

Plate 10, figs. 24*a*–*d*.

Station 5074. Three specimens.

Body fusiform, tapering equally toward both ends; length, exclusive of introvert, 26 mm.; diameter, 11.5 mm. Color gray, with dark brown patches, which are especially abundant in interambulacra. Integument thin, soft and leathery, smooth to the touch. Pedicels very numerous, distributed all over the body, but arranged in a double row in each ambulacrum. Tentacles 10, midventral pair being considerably smaller than the rest. Rather sparsely scattered in general perisome are found table-like buttons (pl. 10, figs. 24*a*, *b*). The disk, which measures $40\text{--}110\mu$ in diameter, with a mean of about 70μ , has four large primary holes and several peripheral ones, numbering from 2 to 16. Spire, $25\text{--}35\mu$ high, consists of two pillars united

once or twice, ending in two diverging spines. Between them are found very rarely modified tables with 4-armed base, up to 160μ in diameter. Pedicels thorny in appearance, owing to the presence of numerous, long-spined buttons (figs. 24c, d). End plate small and rudimentary, with irregular contour. In the introvert are found complicated rosettes, oval in outline, 40μ long. Supporting rods of tentacles are characteristic and are of two principal forms. The slender, distal branches are supported by slender, smooth rods with some holes at each extremity, while in the thick, proximal parts, some are quite rod-like, but others are derived from complicated rosettes, resembling those found in *Echinocucumis adversaria* Semper.¹ There are all sorts of transitional forms between them. Calcareous ring resembles that of *Th. multipes*, but is more slender. Polian vesicle and stone-canal single. Retractors inserted at one-fourth the body length from the contracted anterior end. Respiratory trees well developed; genital tubes unbranched, numerous and slender.

In spite of its close resemblance to *Th. multipes* in external features the present species is characterized by the forms of its deposits in general perisome and tentacles. *Th. fusus* (Müller) and *Th. serratus* Britten differ from it in the shape of the buttons and end plate.

Habitat.—Suruga Bay.

Type.—Cat. No. 34173, U.S.N.M.

74. *THYONE IMBRICATA*, new species.

Station 5023. Four specimens.

Body a short spindle in shape, with mouth and anus directed dorsad. Length, as measured along ventral side, 34 mm.; along dorsal, 14 mm.; diameter, 8 mm. Color pure white from the presence of scale-like deposits which stiffen the integument. Tentacles 10, midventral pair being a little smaller than the rest. Pedicels uniformly scattered all over the body. Scale-like deposits are irregularly oval, with uneven margin, rather thick and complexly latticed; diameter, 0.3–1.2 mm. They are imbricating, but leave here and there narrow interspaces through which the pedicels pass outwards. Near the free margin of each scale stands a short, conical, spinous process projecting obliquely on the body surface, and measuring about 0.45 mm. in length. In the introvert are found scattered, elongated plates with holes and knobs, measuring 0.16–0.4 mm. in length. Pedicels supported by small rods with few holes; an irregular end plate, 0.10–0.17 mm. in diameter, is present. Tentacles richly supplied with supporting rods in the form of curved plates, 0.13–0.26 mm. in length. Calcareous ring well developed, with the posterior margin deeply indented but destitute of tail-like prolongations. Retractors

¹ See Ludwig, Vettor Pisanì Holothurien, 1887, p. 24, pl. 1, fig. 3D.

inserted about 6 mm. from the anterior end. Polian vesicle and stone-canal single, the latter with a comparatively large madreporite. Respiratory trees two, well developed but with very few simple branches. Genital tubes simple and short, each with a single ovum, which measures at most 1.2 mm. in diameter.

This species is remarkable in that the female has a pair of brood pouches, which lie side by side on the ventral body wall and are lined with a thin, noncalcareous membrane, and open by a common orifice situated in the midventral radius, 10 mm. from the anterior end. In these pouches I found ova and young in three different stages of development—mature ova, young, 2 mm. long, and larger ones, 3 mm. or more in length. In one case there were 5 ova and 2 smaller young in the right pouch, and 2 ova, a small young and a larger one, in the other. These larger young seem to be ready for birth, with imbricating scales 300–350 μ in diameter, but devoid of marginal process. The presence or absence of pedicels can not be ascertained owing to the excessive development of scales. The smaller young have rather scattered plates, 180–240 μ in diameter, in body wall. Scattered spicules are also found in tentacles and stone-canal. Calcareous ring and coiled gut are already formed, but pedicels could not be made out.

This species belongs to the group distinguished by Studer as *Trachythyone*, but differs from his *muricata* in the shape of the scalelike deposits and in the absence of cup-shaped bodies.

Habitat.—Off Cape Terpyeniya, Sakhalin.

Type.—Cat. No. 34174, U.S.N.M.

Genus PSEUDOCUCUMIS Ludwig.

75. PSEUDOCUCUMIS DACTYLICUS, new species.

Station 4913. One specimen.

Body fusiform, with oral and anal ends prolonged into dorsally curved, slender, tapering processes. Length as measured along mid-ventrum, 45 mm.; along middorsum, 28 mm.; diameter, 8 mm. Color white, due to large scalelike deposits, which stiffen the integument. Tentacles 15, seldom with a few knoblike rudiments of branches, otherwise simple and finger-shaped. Seven of them are long, about 2 mm.; 2 in the middorsal and right ventral interradii, only 1 in each of the other interradii. The remaining 8 are very short; 1 in the left dorsal and midventral radii and 2 in each of the other 3 radii. Pedicels very minute, arranged in two rows in each ambulacrum, passing through interspaces of scalelike deposits. Around the anus there are 5 papillæ. The scalelike deposits are round in contour with rather even margin, and perforated by large numbers of holes; they do not present complex, latticed, laminar structure, but are simply perforated plates; diameter, 0.45–1.20 mm. They lie imbricated in such a way that in an ideal cross section the free margin is

directed dorsad, and in longitudinal section toward either end of the body. The free margin bears a vertically directed, rudimentary, spiny process. In the introvert irregularly elongated plates with large holes and slight knobs are present; length, 130–270 μ , with a mean of 185 μ ; holes 4–39 in number, averaging 14. Supporting rods of tentacles are arched, narrow plates with several holes and serrated margin, measuring 0.1–0.2 mm. in length. Supporting rods of pedicels are rudimentary and sparse, with a few large holes. End plate, of irregular shape, 90–130 μ in diameter. It is very difficult to make out the true arrangement of the calcareous ring. Radial segments have 2 or 3 anterior processes, but no posterior prolongations. Some interradianal segments seem to be composed of 2 triangular pieces. In general configuration the segments are very much like those of *Cucumaria inflexa* Kœhler and Vaney.¹ Polian vesicle and stone-canal single. Retractors inserted 5 mm. from the anterior end of body. Respiratory trees 2, simple, with rudimentary branches in the shape of globular vesicles. Genital tubes unbranched, in 2 tufts. The third limb of the alimentary canal runs along the left side of the odd ambulacrum.

This species is quite characteristic in the number, form, and relative sizes of its tentacles and in the asymmetry of the calcareous ring. It may be unnatural to refer it to the genus *Pseudocucumis*; probably a new genus should be formed to include this species and the closely allied *Cucumaria digitata* Kœhler and Vaney.

Habitat.—Off Koshiki Islands, west of Kyushu.

Type.—Cat. No. 34175, U.S.N.M.

76. PSEUDOCUCUMIS WATASEI, new species.

Plate 10, figs. 25a,b.

Station 5069. Eight specimens.

Body cylindrical or spindle-shaped, measuring 21 mm. in length, exclusive of the introvert, and 8 mm. in diameter. Color pale white to dirty brown; integument thin and somewhat stiff, slightly rough to the touch. Tentacles 20, of 3 different sizes. The largest 10, one pair to each interradius, alternate with 5 radially situated pairs, which are of 2 sizes. In the paired radii the smaller one is situated ventrally to the larger, and in the odd radius, at the left. Pedicels arranged regularly in 2 rows in each ambulacrum both in trivium and bivium, not crowded. Interambulacra totally devoid of pedicels. General perisome uniformly beset with numerous tables (pl. 10, figs. 25a, b). Disk round or slightly elliptic, with entire margin. Central hole large, usually with an X-shaped span on the underside (fig. 25b). Peripheral holes 8 in number normally, but may increase to 11. Spire consists of 2 converging pillars, united by a crossbeam and

¹ Les Holothuries littorales, 1908, pl. 2, fig. 9.

armed with a few apical teeth. Mean diameter of disks about 90μ (63 – 126μ); height of spire 40 – 50μ . Tables in the introvert are somewhat irregular in form but similar in size, with a disk pierced by numerous large holes. Five anal teeth present. Pedicels supported by modified tables with elongated disk and two-pillared spire; length of disks 110 – 120μ , height of spire 40 – 60μ . End plate well developed, measuring 140 – 185μ in diameter. Supporting rods of tentacles irregularly branched and perforated. Calcareous ring resembles that of *Ps. africanus* (Semper), but lacks the posterior prolongations. Retractors inserted to body wall at about two-fifths the body length from the anterior end. Polian vesicle and stone-canal single, the latter ending in a fungiform madreporite. Respiratory trees 2, with a few simple branches. Genital tubes branched twice dichotomously, in 2 tufts.

The present species resembles *Ps. bicornatus* Dendy and Hindle in the form of its tables and calcareous ring, but differs from it in having tentacles of 3 different sizes, in the lesser crowding of the pedicels, and in the presence of an X-shaped spanning bar on the underside of the table disks. I take great pleasure in naming this new species for Prof. Shozaburo Watase, of Tokyo Imperial University.

Habitat.—Suruga Bay.

Type.—Cat. No. 34176, U.S.N.M.

77. PSEUDOCUCUMIS SAGAMIENSIS, new species.

Plate 10, figs. 26a, b.

Station 5088. One specimen.

Body spindle-like, with both extremities tapering and turning dorsad. Length, as measured along the ventral median line, 27 mm.; along the dorsal, 16 mm.; diameter, 6 mm. Color dirty brown all over; integument thin and stiff, rough to the touch. Only 14 tentacles are present, the small midventral one probably lost by accident. Ten of them are large and are situated interradially in pairs; the others are small and are radial in position. Pedicels nonretractile, arranged in two rows along each ambulacrum. Interambulacra naked, the middorsal interambulacrum being twice as broad as the others. General perisome thickly beset with tables (pl. 10, figs. 26a, b). Disk almost round, 115 – 250μ in diameter, average 190μ , perforated with small holes, usually 13 in number, but varying from 7 to 22. Spire about 100μ high, consisting of two pillars united twice and ending with a few obtuse teeth. Tables in the introvert sparsely scattered, 90 – 140μ in diameter, averaging 110μ , with holes 5–15 in number, averaging 8; height of spire 50μ . Pedicels supported by modified, elongated tables, about 85μ long. End plate not well developed. Supporting rods of tentacles fusiform, with 4 large holes in the middle and small ones irregularly

arranged at both ends. Anal teeth 5, in the shape of simple perforated plates. Calcareous ring without posterior prolongations, wavy in the posterior margin. The radial segment has two unequal incisions on its broader anterior margin, besides the deep, median notch. Interradials triangular in shape. Retractors inserted at about two-fifths the body length. Polian vesicles 2, stone-canal 1. Respiratory trees 2, opening into a long cloaca at its beginning. Genital tubes branched once or twice, in 2 tufts.

Ps. discrepans (Sluiter), the only 15-tentacled stichopoda hitherto known, differs from the present species in having tables with a 4-pillared spire and calcareous ring with posterior prolongations.

Habitat.—Sagami Sea.

Type.—Cat. No. 34177, U.S.N.M.

78. PSEUDOCUCUMIS TABULATUS, new species.

Plate 10, figs. 27a-c.

Station 4900. Two specimens.

Station 4904. One specimen.

Body fusiform and curved. Length, as measured along ventral median line, 26 mm.; along dorsal, 18 mm.; diameter, 8 mm. Color dirty grayish-brown; integument thin and stiff, rough to the touch. Tentacles 20, 5 very minute, radial in position, the other 15 apparently of uniform size. Pedicels nonretractile, arranged sparsely in 2 rows in each ambulacrum, numbering above 40 in trivium, and less than 30 in bivium. Three dorsal interambulacra have in their middle region a very few scattered pedicels. Deposits of general perisome are robust tables uniformly distributed (pl. 10, figs. 27a-c). Disk almost round, 90–185 μ in diameter, mean about 145 μ , perforated with small holes numbering 8–22, most commonly 12 or 13. Central hole very large, covered with an arched cross, on each arm of which stands a robust pillar forming together a conical spire. The pillars number usually 4, but may often increase up to 7. The spire is about 67 μ high, armed with a number of minute teeth (figs. 27a, b). The central hole of the disk is also covered over on the under side by an irregularly branched arch (figs. 27b, c). Tables of smaller size quite regular in shape, with a 4-pillared spire and 8 large peripheral holes arranged in a circle. Deposits of the introvert are scattered, elongated plates with many holes and serrated margin, measuring 30–150 μ in length. Anus surrounded by 5 anal teeth. Pedicels richly beset with modified tables with elongated disk and 4-pillared, toothed spire; length of tables, 97–180 μ . End plate well developed, measuring 175–225 μ in diameter. Supporting rods of tentacles smooth and curved, with several minute holes at the slightly expanded ends. Calcareous ring made up of 10 segments, each with a deep posterior notch, but without posterior prolongations. Retractors inserted

at one-fourth the length of body. Polian vesicle and stone-canal single, the latter ending in a folded madreporite. Respiratory trees 2, short, with a few branches. Genital tubes in the shape of vesicles, in 2 tufts.

This species is characterized by its robust tables. From *Ps. mixta* Östergren it differs in the shape of deposits and calcareous ring.

Habitat.—Off Goto Islands, west of Kyushu.

Type.—Cat. No. 34178, U.S.N.M.

Genus AMPHICYCLUS Bell.

79. AMPHICYCLUS JAPONICUS Bell.

Amphicyclus japonicus BELL, Studies in the Holothuroidea, vol. 3, 1884, pp. 253-254.—OHSHIMA, System of Phyllophorinæ, 1912, pp. 71-76, pl. 1, figs. 5, 6, text-figs. 2, 3a-o.

Pseudocucumis japonicus LUDWIG, Alte und neue Holothuriënarten, 1887, p. 1239.—AUGUSTIN, Japanische Seewalzen, 1908, p. 29.

Station 5069. Three specimens.

For a detailed account of this species, I refer to my former paper.

Habitat.—Tsugaru Strait (Bell, 1884); Uraga Channel (Augustin, 1908); Numa, Sagami Sea; Suruga Bay; Province Echizen ? (Ohshima, 1912).

Genus PHYLLOPHORUS Grube.

80. PHYLLOPHORUS CYLINDRICUS, new species.

Plate 11, figs. 28a, b.

Station 5021. One specimen.

Body long and cylindrical, of almost uniform diameter throughout, ending bluntly at both extremities, where the mouth and anus open. Length, 100 mm.; diameter, 13 mm. Color, gray all over. Integument thick, full of creases and slightly rough to the touch. Tentacles deep purplish-black in color; only 12 are present, of which 8 are large and 4 small. Pedicels contracted, distributed all over the body without any serial arrangement, except near the posterior end, where they form a double row in each ambulacrum. General perisome with rather scattered tables (pl. 11, figs. 28a, b). Disk irregular, with serrated contour, and 6-28 holes arranged in a circle or two concentric circles; disk diameter 130-225 μ , with a mean of 170 μ . Over the large central hole spans an arch with 4, very rarely 3 or 5, arms, on each of which stands a pillar. These pillars unite to form a spire which ends with an incomplete, toothed crown. Height of spire, 60-130 μ . Similar but more irregular tables are found in pedicels. End plate single, well developed, measuring 0.4-0.6 mm. in diameter. The introvert tables have delicate disk, measuring 150-260 μ , and with an imperfect spire. Toward the base of the tentacles these tables gradually give place through many interme-

diate forms to elongated, spinose plates, 320–640 μ long. Tentacles supported by rodlike, spinous plates, up to 680 μ in length. Anal papillæ and teeth present. Calcareous ring consists of 10 narrow segments, 9 mm. long and 3 mm. wide, each with a deep posterior indentation, but no prolongations. The anterior margin of radial segments is divided into 2 unequal halves. Retractors inserted to body wall at different levels; the midventral one 16 mm., the dorsal ones 23 mm., from the anterior end of body. Polian vesicle and stone-canal single. Genital tubes unbranched. Respiratory trees 2, each consisting of a thick stem and 2 rows of side branches.

This species is characterized by its cylindrical, *Synapta*-like body and the narrow segments of its calcareous ring. Judging from the shape of the calcareous ring, the normal number of tentacles is probably 15, and *Orcula luminosa* Lampert is very close to it. Though *O. barthii* Troschel has been reported as being destitute of deposits, the tables figured by Kalischewskij¹ resemble those of the new species.

Habitat.—Off Cape Terpyeniya, Sakhalin.

Type.—Cat. No. 34179, U.S.N.M.

81. PHYLLOPHORUS GLAUCUS, new species.

Plate 11, figs. 29a–c.

Station 4782. One specimen.

Body fusiform, much tapering toward the posterior end. Length 40 mm., including the well defined introvert of 3.5 mm.; diameter, 13.5 mm. Integument transversely wrinkled, rough to the touch. Color purplish-gray, with tips of pedicels colored blackish-purple. Tentacles 15, of 2 different sizes. Ten are large, situated interradially in pairs; the other 5 are small, radial in position, and form an inner circle. Pedicels nonretractile, arranged in more or less conspicuous rows all over the body with the exception of the introvert; much more crowded in trivium than in bivium, where they form distinct double rows in the radii. General perisome and pedicels stiffened with numerous tables (pl. 11, figs. 29a–c). They resemble those found in *Pseudocucumis tabulatus*, with round disk and robust spire. Mean diameter of disks, 130 μ ; range, 90–185 μ ; peripheral holes usually in a single circle, numbering 9–25. Spire consists of 4–7 pillars, 55–75 μ high, ending with numerous apical spines. On the under side of the disk an irregularly branched arch covers the large central hole (fig. 29c). Tables in the introvert are almost of the same size as the foregoing, but the margin of disk is serrated or spinose. Five anal teeth present. Tables in pedicels are similar to general perisome, only smaller, averaging 100 μ in diameter. End plate well developed, 350–400 μ in diameter. Scattered in dorsal perisome are found small end plates, measuring 90–160 μ in diameter, representing rudimentary

¹ Echinodermenfauna d. sibir. Eismeeres, 1907, pl. 1, figs. 4b, c.

pedicels. Tentacles are supported by oval or elongated, knobbed plates up to 0.5 mm. in length. Radial segments of calcareous ring without posterior prolongations, with the anterior margin divided into unequal halves. Retractors inserted to the body wall less than one-third of the body length, from the anterior end. Polian vesicle and stone-canal single. Genital tubes dichotomously branched near the base, forming 2 tufts. Respiratory trees 2, with pinnate branches.

Orcula luminosa Lampert is very close to the present species, only differing in the smaller number of large, plump tables in the perisome and the absence of tables from the pedicels.

Habitat.—Aleutian Islands.

Type.—Cat. No. 34180, U.S.N.M.

82. *PHYLLOPHORUS DIOMEDEÆ*, new species.

Plate 11, figs. 30a, b.

Station 4994. Three specimens.

Station 5046 or 5047. One specimen.

Body fusiform, gradually tapering posteriorly, 36.5 mm. long, 9 mm. across. Integument soft, rough to the touch, white to yellowish-brown in color. Tentacles gray in color, 15 in number, of which 10 are large and interradian in position, while the other 5 are very minute and lie one in each radius. Pedicels small and short, forming a double row in each ambulacrum, and irregularly scattered in all interambulacral spaces. Deposits of general perisome are tables (pl. 11, figs. 30a, b); disk nearly quadrangular, with wavy margin, a large central hole and 4–20 peripheral ones. Diameter of disks 83–160 μ , with a mean of about 105 μ . Spire, 50–80 μ high, made up of 4 pillars, connected twice by crossbeams and ending with numerous, minute teeth. Tables in the introvert are very irregular, with serrated margin and numerous holes, equal in size to those of general perisome; spire is often totally absent, or very rarely composed of 5 pillars. Pedicels have tables like those in perisome and an end plate measuring 110–300 μ in diameter. Anus surrounded by 5 teeth and 10 papillæ. Supporting rods of tentacles usually widened at the middle, without knobs and perforated by a few holes. Each radial segment of calcareous ring is divided at its anterior margin into 2 unequal halves. Retractors inserted less than one-fourth of the body length from the anterior end. One or two Polian vesicles, one stone-canal. Respiratory trees 2, opening at the anterior end of the long cloaca.

The species resembles my *Ph. cylindricus*, but differs in the general shape of its body and in the shape and size of its tables. These are similar to those of *Orcula tenera* Ludwig, but they seem to be very sparse in that species and moreover the calcareous ring has long posterior prolongations.

Habitat.—Off Rebun Island, Hokkaido; off Ojika Peninsula.

Type.—Cat. No. 34181, U.S.N.M.

83. PHYLLOPHORUS MINUTUS, new species.

Plate 11, figs. 31a, b.

Station 4900. Two specimens.

Body indistinctly pentangular, with bluntly ending extremities, 13.5 mm. in length and 5 mm. in diameter, Integument thin and soft, smooth to the touch, white all over. Tentacles 20, of 2 different sizes; 10 interradial larger than the 10 radial, which form an inner circle. Pedicels retractile, forming a zigzag or double row along each ambulacrum. Very minute pedicels invisible to the naked eye scattered in the three dorsal interambulacra. Deposits of general perisome are table-like buttons, quite regular in shape (pl. 11, figs. 31a, b); disk quadrangular or rhombic, with large holes numbering from 4 to 10, usually 8; mean diameter of disks about 83μ , range $60\text{--}120\mu$. From the central bar, which separates the 2 pairs of largest holes, arise a pair of pillars which unite once and give off 4–8 short teeth at the top. Height of spire, $20\text{--}27\mu$. In the introvert the tables are slightly smaller, $45\text{--}100\mu$, often irregular and rod-like in shape. In pedicels are found much robust and elongated tables with 2 pairs of holes at the middle and a few at each end. The two prolongations of the disk often do not lie in a straight line as in *Ph. alexandri* (Fisher). End plates of pedicels larger in the ambulacra, measuring $220\text{--}280\mu$ in diameter, in the interambulacra only $100\text{--}200\mu$; single small end plates often representing rudimentary pedicels. Supporting rods of tentacles smooth, with expanded or branched ends perforated by minute holes. Anus with 5 teeth and 10 papillæ. Calcareous ring similar to that of *Ph. intermedius* Kœhler and Vaney, only differing in that the anterior margin is not oblique and in that the segments are united together by one-half of their length. Retractors inserted to body wall slightly behind the middle of body, the midventral one being most anterior. Polian vesicle and stone-canal single. Genital tubes apparently immature, unbranched, few in number. Respiratory trees 2.

This species stands very close to *Ph. intermedius* in many respects, but differs from it in the shape of the calcareous ring and deposits. *Ph. alexandri* from Hawaii is also very nearly allied to the present species, but differs by the presence of numerous pedicels in the dorsal interambulacra, besides having calcareous ring and tables of different shapes.

Habitat.—Off Goto Islands, west of Kyushu.

Type.—Cat. No. 34182, U.S.N.M.

Genus **PSOLUS** Oken.84. **PSOLUS SQUAMATUS** (Koren).

Cuvieria squamata KOREN, Nyt Magazin for Naturvidenskaberne, vol. 4, 1844, pp. 211-225, pls. 2, 3.

Psolus squamatus LUDWIG, Arktische und subarktische Holothurien, 1900, pp. 158-159.—ÖSTERGREN, Holothurioidea of Northern Norway, 1902, pp. 10-11.—

VANEY, Expédition antarctique Française, 1907, pp. 27-28.—MITSUKURI, Actinopodous Holothurioidea, 1912, pp. 225-227, pl. 7, figs. 61-62, text-fig. 42.

Psolus asper AUGUSTIN, Japanische Seewalzen, 1908, pp. 30-31, pl. 2, fig. 4, text-fig. 20.

Station 5017. One specimen.

Station 5032. Seven specimens.

Station 5033. One specimen.

According to Östergren the specimens referred to this species by Bell (1882), Pfeffer (1890), Sluiter (1895), and Bidentkap (1899) belong to other species. According to Vaney, the name *Ps. squamatus*, var. *segregatus*, in Mitsukuri's list of synonyms should also be canceled. I think that Augustin's *Ps. asper* from Sagami Sea should probably be referred to this widespread and rather variable species.

Habitat.—Various localities in the North Atlantic (see Ludwig, 1900); Pacific coast of Chile (Théel, 1886); California and Lower California (Clark, 1901, 1913); Kuriles (Jæger, 1833); Sagami Sea (Augustin, 1908; Mitsukuri, 1912); east coast of Southern Sakhalin; Nemuro Strait, Hokkaido.

85. **PSOLUS CHITONOIDES** Clark.

Psolus chitonoides CLARK, Echinoderms from Puget Sound, 1901, pp. 335-337, pl. 3, figs. 5, 6; pl. 4, figs. 6-10.

Psolus californicus FISHER, Zool. Anz., vol. 29, No. 18, 1905, pp. 573-576, text-figs. 1-13.

Station 4784. Three specimens.

Station 4790. Two specimens.

The largest specimen is 60 mm. long, 47 mm. wide, and 26 mm. thick. In the middle part of the odd ambulacrum a few scattered pedicels are present, but only in large individuals. The characteristic plates in the sole measure 100-310 μ in diameter, with holes numbering above 20. End plate of pedicels is single in young individuals but becomes multiple in older ones. Of the triangular scales around the mouth the interr radial 5 are larger, the inequality being more emphasized in the young. There are about 7 scales between the mouth and the anus, 20-22 in a transverse line where the body is broadest. The specimens before me agree with those of *Ps. californicus* in almost every point, but differ by the presence of a complete series of midventral pedicels in the latter. This again seems to be referable to *Ps. chitonoides*, though the latter is rather briefly described and shows some slight differences.

Habitat.—Puget Sound (Clark, 1901); Monterey Bay, California (Fisher, 1905); Aleutian Islands.

86. (?) *PSOLUS JAPONICUS* Östergren.

Psolus japonicus ÖSTERGREN, Zur Anatomie der Dendrochiroten, 1898, pp. 135–136.—BRITTEN, Holothuriens a. d. japan. u. ochotsk. Meere, 1907, pp. 146–147.—OHSHIMA, Zool. Mag. (Japanese), vol. 25, No. 293, pp. 130–132, pl. 5, figs. 1–9.

Station 4807. Two specimens.

Station 4808. Two specimens.

The largest specimen measures 40 mm. long, 32 mm. wide, and 10 mm. thick. Deposits of sole in a single layer, only 100–280 μ in diameter; differing from those of *Ps. squamatus* in that the solid interspaces are broader than apertures and that knobs extend to form a second layer. There are 10–11 scales between the mouth and the anus, 20–30 in a transverse line at the broadest part of the body.

My identification may be criticized. The specimens differ from those described by Östergren and Britten, first, in that the dorsal scales are thin and numerous; second, in the absence of large plates 0.4 mm. wide; and third, in the occasional presence of some scattered pedicels in the odd ambulacrum. They can not be referred to any other known species.

Habitat.—Tsugaru Strait (Östergren, 1898); west coast of southern Sakhalin (Britten, 1907).

Genus *PSOLIDIUM* Ludwig.87. *PSOLIDIUM VITREUM*, new species.

Plate 11, fig. 32.

Station 4979. One specimen.

Station 5084. Three specimens.

Station 5087. Five specimens.

Body as seen from dorsum elliptic, with a strongly vaulted dorsum and a concave ventrum very sharply distinguishable from the other parts. Mouth anterodorsal, anus decidedly dorsal, both borne on a low, conical prominence. Young individuals are quite flat. As measured in the largest specimen, sole is 21 mm. long and 14 mm. wide; distance from mouth to anus, 20 mm.; height of body about 9 mm. Color white and glassy all over, ventral sole very thin and semi-transparent. Tentacles 10, midventral pair being smaller than the rest. Pedicels nonretractile, arranged in a zigzag row in each ventrolateral ambulacrum, just on the edge of the sole. The odd ambulacrum has only a very few, sparsely scattered pedicels. Minute papilla-like pedicels are sparsely scattered all over the dorsum. They are 350 μ long and 100 μ across. Deposits of sole are round or oval plates often overlapping one another (pl. 11, fig. 32); holes large, quite regularly arranged, 6.5–53 μ across, average 25 μ , smaller or often obliterated in old individuals. At each node of the

mesh is a round knob, which gives rise very rarely in young individuals to an irregular network over the original plate, but becomes inconspicuous in old ones. Mean diameter of plates and number of holes increase with age. In the largest specimen these plates may measure 400μ in diameter and have 36 holes. Dorsal scales thin, smooth, round in outline, lying imbricated upon one another. Except those lying quite near the ventral margin, they show no considerable differences in size, being 1.0–1.5 mm., and only rarely 2.5 mm., in diameter. Some of these scales may have a hole, through which the dorsal pedicel is given out. Around the mouth and the anus the scales are triangular in shape and show no regular arrangement. In the largest specimen there are 27 scales between the mouth and the anus and 30 in a transverse line at the widest part of the body. Between the anterior margin of the sole and the mouth there are 10, between the anus and the posterior margin of the sole, 12. Ventral pedicels have arched, elongated plates with two rows of holes, and an end plate measuring $150\text{--}180\mu$ in diameter. Pedicels of dorsum have simple supporting rods and a small end plate. Supporting-rods of tentacles are similar to those of pedicels but broader and have more holes. Calcareous ring consists of 10 slender segments with no posterior prolongations. The ventral interradians are closely pressed on to the midventral radial segment. Polian vesicle and stone canal single. Genital tubes numerous and undivided. Respiratory trees 2, weakly developed.

In the form of the body and the arrangement of the ventrolateral pedicels the present species resembles *Ps. dorsipes* Ludwig, but differs from it in the following points: First, dorsal pedicels few and inconspicuous, each passing through a pore in the scale; second, deposits of sole of only one kind; and, third, pedicels very few along the odd ambulacrum. The specimen described by Théel as *Psolus* sp. (?) (*Blake Holothurioidea*, 1886, pp. 15, 16) seems to be a young of an allied species. *Psolus incertus* Théel is also very near to this species.

Habitat.—South of Totomi; Sagami Sea.

Type.—Cat. No. 34183, U.S.N.M.

88. *PSOLIDIUM BULLATUM*, new species.

Plate 11, fig. 33.

Station 4779. One specimen.

Body oval in dorsal aspect, dorsum vaulted, ventrum concave. Mouth and anus dorsal. Sole 12.5 mm. long and 10.5 mm. broad; thickness of body, 3.5 mm.; distance from mouth to anus, 11 mm. Color white all over, with rather coarse granules on the dorsal scales. In external appearance the animal very much resembles *Psolus fabricii* (Düben and Koren). Tentacles 10, midventral pair slightly

smaller than the others. Pedicels form 2 rows along the margin of sole, the inner row being very conspicuous, consisting of larger pedicels arranged alternately. The odd ambulacrum has at both ends some pedicels arranged in a double row, while in the middle part only a very few, weakly developed ones are present. Dorsal pedicels very minute, $80\text{--}150\mu$ in diameter. Deposits of sole are heavy, knobbed plates, often overlapping one another (pl. 11, fig. 33). They range $90\text{--}260\mu$ in diameter, with a mean of about 150μ ; holes usually 8 or 9 in number, varying 1–33. Diameter of holes averages 20μ , ranging $7\text{--}38\mu$. Pedicels and tentacles with numerous arched plates without knobs. End plate of ventral pedicels $270\text{--}300\mu$ in diameter. In dorsal pedicels are found rudimentary end plate and supporting plates. Dorsal scales are rather uniform in size, up to 1.2 mm. in diameter, imbricating, with large granules measuring $150\text{--}200\mu$ across. There are about 17 scales between the mouth and the anus, 25 in a transverse line where the body is widest, 7 in front of mouth, and 9 behind anus. No enlarged or regularly arranged scales around the mouth and anus. Dorsal pedicels mostly passing through a pore or pores in a scale, there being often three or more of these pores in a single scale. Calcareous ring with no posterior prolongations. Polian vesicle and stone-canal single. Genital tubes unbranched. Respiratory trees two, tolerably developed.

Ps. disjunctum Sluiter differs from this species in the shape of its deposits in the sole and the distribution of its dorsal pedicels. *Ps. rugosum* Koehler and Vaney is also closely related to the present species, but differs by the greater number of its scales, a richer development of the granules on the latter, and the smaller number of its midventral pedicels.

Habitat.—Aleutian Islands.

Type.—Cat. No. 34184, U.S.N.M.

Family SYNAPTIDÆ Burmeister.

Genus PROTANKYRA Östergren.

89. PROTANKYRA KAGOSHIMENSIS, new species.

Plate 11, figs. 34a–c.

Station 4945. Nine fragments.

Length over 125 mm., diameter up to 15 mm. Color reddish-brown with a tinge of green. Integument transversely wrinkled, sticky from the presence of large anchors. Tentacles 12, each with 2 pairs of digits, of which the terminal ones are larger. The anchor (pl. 11, fig. 34a) is large and slender, with the stock divided in the shape of a T, its surface being finely serrulate. The top is smooth, but each arm has on its middle part about a dozen teeth. Length of anchors ranges

410–980 μ , with a mean of 740 μ , span breadth of arms 270–610 μ , with a mean of 470 μ . The anchor plate (fig. 34b) is oval, with a transverse ridge near its narrowed hinge end. Holes are very numerous, each lined with fine teeth; they are small and regular in the central part but large and irregular toward the periphery. Length of anchor plates 320–840 μ , with a mean of 605 μ , breadth 260–620 μ , with a mean of 490 μ . Anchors and anchor plates are small in the anterior region. Miliary granules are of the form of curved rods or parentheses (fig. 34c), measuring 20–60 μ in length. These are especially clustered on low round prominences, measuring 160 μ across and sparsely scattered on the skin. In digits of tentacles they are more slender and 40–90 μ long, with short branches at each end. In the radial muscles and the deeper part of the wall of the tentacles are found very plump, oval or sausage-shaped granules. Calcareous ring 2 mm. high, with a stone canal and 7 Polian vesicles attached to it. Muscles well developed, the radial bands measuring 5.5 mm. in breadth. Next to the esophagus the alimentary canal presents a spherical dilation, 6 mm. in diameter, followed by a muscular stomach, 30 mm. long and 2.5 mm. thick. Genital tubes branched once or twice. Ciliated funnels not very numerous, found in the left dorsal interradius.

P. insolens (Théel) is doubtless very akin to this new species, but differs by the form of its miliary granules and by the holes of the anchor plates being larger toward the center. The species also very much resembles *P. benedeni* (Ludwig) and *P. denticulata* Koehler and Vaney, differing only in the shape of the deposits.

Habitat.—Kagoshima Bay, Kyushu.

Type.—Cat. No. 34185, U.S.N.M.

Genus ANAPTA Semper.

90. ANAPTA (?), species.

Station 5080. One specimen.

The specimen lacks its posterior part, measuring only 20 mm. in length and 6 mm. in diameter. Color dirty gray. Tentacles 12, with 7 digits. Deposits totally absent, probably dissolved by the action of acid. Calcareous ring very weak, embedded in a connective tissue. Viscera all ejected.

Habitat.—Off south of Izu Peninsula.

Genus CHIRIDOTA Eschscholtz.

91. CHIRIDOTA ALBATROSSII Edwards.

Chiridota albatrossii EDWARDS, *Albatross Holothurians*, 1907, pp. 50–52, text-figs. 1a–c, 2d–f, 3.

Station 4993. One fragment.

Station 4994. Ten fragments.

- Station 5006. Ten fragments.
- Station 5007. Ten fragments.
- Station 5008. Eight fragments.
- Station 5009. Two fragments.
- Station 5018. Two complete specimens and five fragments.
- Station 5020. Two complete specimens and two fragments.
- Station 5021. Two complete specimens and two fragments.
- Station 5022. Four fragments.
- Station 5023. Eight fragments.
- Station 5026. Three fragments.
- Station 5029. One fragment.
- Station 5032. One fragment.
- Station 5033. One complete specimen and six fragments.
- Station 5043. Nine fragments.
- Station 5044. One complete specimen and four fragments.
- Station 5045. One fragment.

The largest specimen measures 235 mm. in length and 14 mm. in diameter. Tentacles normally 12, but exceptionally 10, each carrying 5-7, or even 9, pairs of digits. Wheel papillæ up to 2 mm. in diameter, forming a single row in the 3 dorsal interambulacra, but often confined to the middorsal one only. Wheels vary in diameter between 80 and 200 μ , with a mean of 145 μ . Spokes vary exceptionally from 4 to 9 in number. Very often there is a small triangular pore at the center, in place of the "Mittelpfeiler." The irregular branching rods measure 90-200 μ in length, and may be totally absent in some individuals. Polian vesicles 20 in number in one specimen.

The original specimens are described by Edwards as having much smaller wheels and rods than in those before me. There is, however, no doubt as to their specific identity.

Habitat.—Queen Charlotte Sound, off Fort Rupert, Vancouver Island, British Columbia; Boca de Quadra, vicinity of Naha Bay, Behm Canal, and junction of Clarence Strait and Behm Canal, south-east Alaska (Edwards, 1907); off Cape Terpyeniya and south ends of Sakhalin; off Rebun Island; Nemuro Strait; and off Hitaka, Hokkaido.

92. CHIRIDOTA DISCOLOR Eschscholtz.

Chiridota discolor ESCHSCHOLTZ, Zoologischer Atlas, 1829, pp. 12-13, pl. 10, fig. 2.—

CLARK, The Apodous Holothurians, 1907, pp. 26-28, 120.

Liosoma sitchænse BRANDT, Prodromus, 1835, p. 58.

Unalaska. Five specimens.

Nikolski, Umnak Island. Three specimens.

The largest specimen is 37 mm. long and 7 mm. across. Integument soft and muscular, gray in color with minute, reddish pigment spots. Tentacles 12, digits 4-5 pairs. Deposits, wheels only; wheel papillæ in both dorsal and ventral interambulacra. Diameter of

wheels 50–105 μ , with a mean of 82 μ . Polian vesicles 7 in one specimen. Genital tubes once or twice branched. Ciliated funnels especially numerous in the left dorsal interambulacrum.

It is with much hesitation that I refer the specimens to this species, depending mainly on the fact that they are from the shores of Aleutian Islands, which are known as its home. Compared with the specimens of *Ch. lævis* (Fabricius) from Eastport, Maine, the specimens before me differ in the absence of branched rods from the tentacles.

Habitat.—See Clark, 1907, pages 27, 120.

Genus TÆNIOGYRUS Semper.

93. TÆNIOGYRUS CIDARIDIS, new species.

Station 4900. Nine specimens.

Body irregularly distorted, measuring at most 30 mm. long and 3.5 mm. in diameter. Two of them were found attached to a disk-bearing spine of *Cidaris* (*Goniocidaris*) *clypeata* Döderlein by their coiled posterior parts. Color white, skin rough to the touch. Tentacles 10, with 4–5 pairs of digits. Wheel-papillæ numerous on the dorsal side, probably totally absent from the ventral interambulacra except in the anterior part. Wheels are of the ordinary shape, measuring 30–135 μ in diameter, increasing in size towards periphery of the papilla. Hooks 120–185 μ long, 154 μ on an average, not gathered into hook-papillæ, but scattered in the perisome and more numerous in the ventrum than in the dorsum. Supporting rods of tentacles are smooth, slightly thickened at the middle part, and with short bifurcations at each end. Calcareous ring composed of 10 segments. Polian vesicle and stone-canal single. Genital tubes once or twice branched. Ciliated funnels could not be made out.

Though resembling *T. contortus* (Ludwig) in many respects, this species differs by the number of its tentacles and Polian vesicles. From both *T. australianus* (Stimpson) and *Trochodota dunedinensis* (Parker) it differs by the distribution of its deposits. *T. allani* Joshua differs from it in having much larger wheels and in the shape of its tentacle rods.

Habitat.—Off Goto Islands, west of Kyushu.

Type.—Cat. No. 34186, U.S.N.M.

Genus TOXODORA Verrill.

94. TOXODORA PACIFICA, new species.

Plate 11, fig. 35.

Station 5073. One complete specimen and three fragments.

Body cylindrical and long, 145 mm. in length and 14 mm. in diameter. Color purplish-gray all over, but very light in distended parts, where the body wall is thin and translucent. Tentacles 12 in number, each provided at the top with 3 pairs of digits of equal size. Deposits of only one kind, in the shape of parentheses, often with a little knot

at the middle (pl. 11, fig. 35); length 370–665 μ , with a mean of 517 μ . These are uniformly scattered in the general perisome as well as in the walls of the tentacles and their digits. Calcareous ring consists of 10 segments, 1.2 mm. high. Polian vesicles 6, stone-canal single and coiled in its course. Genital tubes once or twice branched near base. Genital papilla situated in the middorsal interradius, close behind the tentacular crown. Ciliated funnels few, scattered along the middorsal line and the left dorsal interradius.

This genus has been represented by a single species, *T. ferruginea* Verrill of the Atlantic, from which the present one differs by its much greater size and the small number of tentacle digits.

Habitat.—Suruga Bay.

Type.—Cat. No. 34187, U.S.N.M.

Genus MYRIOTROCHUS Steenstrup.

95. MYRIOTROCHUS RINKII Steenstrup.

Myriotrochus rinkii STEENSTRUP, Videnskabelige Meddelelser fra den naturhistoriske Forening, 1851, pp. 55–60, pl. 3, figs. 7–10.—THÉEL, Note sur quelques Holothuries, 1877, pp. 3–11, pl. 1, figs. 1–13.—DANIELSSEN and KOREN, Holothurioidea, 1882, pp. 28–31, 79, 81, pl. 5, figs. 1–4; pl. 13, fig. 1.—LUDWIG, Über die Rädchen der Synaptiden, 1892, pp. 358–360, pl. 16, figs. 12–14; Arktische und subarktische Holothurien, 1900, pp. 166–167.—NORMAN, Natural History of East Finmark, 1903, pp. 415–417, pl. 27, figs. 5–9.—KALISCHESKIJ, Echinodermenfauna d. sibir. Eismeer, 1907, pp. 9–11.—CLARK, The Apodous Holothurians, 1907, pp. 30–31, 128, pl. 8, figs. 21–22.

Chirodota brevis HUXLEY, Journal of Penny's Voyage, 1852, pp. 221–222.

Myriotrochus brevis DANIELSSEN and KOREN, Holothurioidea, 1882, pp. 31–35, 79–80, 81, pl. 5, figs. 5–7.

Station 4798. Fifty-one specimens, of which 37 are complete.

The largest individual measures 32 mm. in length and 8 mm. in diameter. Diameter of wheels, 160–250 μ ; number of spokes, 15–21; that of inward processes, 19–25.

Habitat in the North Pacific.—Lorenz Bay and Plover Bay (Ludwig, 1886); near Pribilof Islands (Clark, 1907); west coast of Kamchatka. The limits of distribution recorded by Ludwig (1900) have recently been widened by Kalischewskij (1907) and Clark (1907), to the east up to Bennett Island, longitude 147° 27' E., and to the south, off the banks of Newfoundland, latitude 45° 35' N.

96. MYRIOTROCHUS MITSUKURII, new species.

Plate 11, fig. 36.

Station 4983. Two complete specimens and three fragments.

Station 4984. Two specimens.

Station 4985. One specimen.

Station 4988. One specimen.

Body cylindrical, 35 mm. long and 8 mm. across. Integument soft and muscular, smooth to the touch, white and translucent.

Tentacles short, 12 in number, with about 8 pairs of minute digits around the external, flattened surface; tips of digits tinged with brown. Deposits of general perisome sparsely scattered, except on the ventral side; they are wheels much resembling those of *M. rinkii* except in their larger size, the greater number of the inward processes and in the latter being slightly shorter. Diameter of wheels 215–365 μ , with a mean of 282 μ . Spokes 12–21 in number, averaging 17; inward processes 22–33, averaging 27. In tentacles are found very characteristic deposits which remind one of the *Acanthotrochus* wheel (pl. 11, fig. 36). They vary very much in size as well as in shape. Nave is solid, very often with a minute knob or so-called “stalk,” or sometimes a stellate figure, at the center; spokes not bent and all in one plane; felly with short teeth on its internal and external sides, usually more numerous than the spokes; both the internal and external teeth are often inconspicuous or may be totally absent. Diameter of these wheels, including the outward processes, 55–205 μ ; number of spokes, 8–21; that of the outward processes, 19–27. Calcareous ring very stout, consisting of 10 segments, which measure 1.5 mm. in breadth, and with one or two spines anteriorly. Polian vesicle and stone-canal single, the latter with calcareous network in its wall. Genital tubes divided, in two tufts, immediately behind the calcareous ring. No ciliated funnels.

This species differs from all others of the genus in having the characteristic spinous wheels in the tentacles. *Acanthotrochus mirabilis* Danielssen and Koren differs from this species in having in the general perisome large spinous wheels with 8 spokes and wing-like expansions to each spoke. The new species is named in honor of the late Prof. Kakichi Mitsukuri, to whom the advancement of our knowledge of Japanese holothurians is in a large measure due.

Habitat.—Off the coast of Shiribeshi, Hokkaido.

Type.—Cat. No. 34188, U.S.N.M.

EXPLANATION OF PLATES.

(All figures are drawn by the author.)

PLATE 8.

Fig. 1. *Synallactes multivesiculatus*, new species.

a. Triradiate tablelike deposit from ventrum, side view. *b.* Same with disklike base, seen from above. *c.* Ordinary type seen from above. $\times 200$.

Fig. 2. *Synallactes gilberti*, new species.

a. Quadriradiate tablelike deposit from dorsum, seen from above. *b.* Same from ventrum, side view. $\times 300$.

Fig. 3. *Bathyplores östergreni*, new species.

a. Quadriradiate tablelike deposit from base of dorsal papilla, seen from above. *b.* Same seen from side. *c.* Same from ventrum, seen from above. *d.* Same seen from side. $\times 300$.

Fig. 4. *Mesothuria media*, new species.

a. Table from dorsum, side view. *b.* Same seen from above. $\times 300$.

Fig. 5. *Pseudostichopus aleutianus*, new species.

a. Deposit from wall of genital tube. *b.* Same from perianal region, X-shaped type. *c.* Same, rod-like type. $\times 300$.

Fig. 6. *Pseudostichopus molpadioides*, new species.

a, b. Supporting rods of pedicel. $\times 300$. *c.* Deposit from perianal region. $\times 150$.

Fig. 7. *Pseudostichopus unguiculatus*, new species.

a, b. Spicules from wall of genital tubes. *c.* Supporting rod of dorsal papilla. $\times 300$.

Fig. 8. *Pannychia moseleyi virgulifera*, new subspecies.

a. Rod from ventrum, commonest type. *b.* Same, smooth type. $\times 150$.

Fig. 9. *Ilyodæmon miurense*, new species.

a. Large wheel. $\times 200$. *b.* Small wheel. *c.* Complicated rosette. $\times 300$.

PLATE 9.

Fig. 10. *Peniagone japonica*, new species.

Large X-shaped spicule from deeper part of dorsal perisome. $\times 150$.

Fig. 11. *Achlyonice monactinica*, new species.

a. Spicule from wall of genital tube. *b.* Triradiate spicule from ventrum. *c.* Commonest spicule from ventrum. $\times 300$.

Fig. 12. *Benthodytes gotoi*, new species.

Spicule with anchor-shaped spire from papilla. $\times 100$.

Fig. 13. *Stichopus nigripunctatus* Augustin.

- a.* Table with large, entire disk and tall spire, from a young individual, side view.
b. Same, from above. $\times 300$.

Fig. 14. *Molpadia clarki*, new species.

- a.* Table with excentric disk, from side. *b.* Same, from above. *c.* Elongated table from tail. $\times 120$.

Fig. 15. *Molpadia infesta*, new species.

- a.* Table from general perisome. *b.* Rhombic plate from tail. $\times 100$.

Fig. 16. *Capheira mollis*, new species.

- a.* Table seen from above. *b.* Same, side view. $\times 200$.

Fig. 17. *Caudina ludwigi*, new species.

- a.* Spinous table from posterior region seen from above. *b.* Same, side view. *c.* Spinous plate without spire. $\times 120$.

PLATE 10.

Fig. 18. *Cucumaria ijimai*, new species.

- a, c.* X-shaped rods from ventrum. *b.* Same in early developmental stage. $\times 200$.

Fig. 19. *Cucumaria lamperti*, new species.

- a.* Large knobbed plate. *b.* Small smooth button with spines. $\times 100$.

Fig. 20. *Cucumaria spinosa*, new species.

- a.* Typical button with one-holed, tail-like process. *b.* Same seen from side. *c.* Same in early developmental stage. $\times 150$.

Fig. 21. *Cucumaria sluiteri*, new species.

- a.* X-shaped table-like deposit, side view. *b.* Same seen from above. $\times 150$.

Fig. 22. *Cucumaria constricta*, new species.

- a.* Table-like button, side view. *b.* Same, from above. $\times 150$.

Fig. 23. *Thyone parva*, new species.

Spectacle-like body from superficial layer. $\times 200$.

Fig. 24. *Thyone bicornis*, new species.

- a.* Table-like button from general perisome, side view. *b.* Same, from above.
c. Button from pedicel, side view. *d.* Same, from above. $\times 300$.

Fig. 25. *Pseudocucumis watasei*, new species.

- a.* Table-like deposit, seen obliquely from above. *b.* Same, from below. $\times 200$.

Fig. 26. *Pseudocucumis sagamiensis*, new species.

- a.* Table-like deposit seen from above. *b.* Same, from side. $\times 200$.

Fig. 27. *Pseudocucumis tabulatus*, new species.

a. Table-like deposit seen from above. *b.* Same, from side. *c.* Same, from below. $\times 200$.

PLATE 11.

Fig. 28. *Phyllophorus cylindricus*, new species.

a. Table-like deposit seen from above. *b.* Same, from side. $\times 150$.

Fig. 29. *Phyllophorus glaucus*, new species.

a. Table-like deposit seen from side. *b.* Same, from above. *c.* Same, from below. $\times 200$.

Fig. 30. *Phyllophorus diomedæ*, new species.

a. Table-like deposit seen from above. *b.* Same, from side. $\times 200$.

Fig. 31. *Phyllophorus minutus*, new species.

a. Table-like button seen from above. *b.* Same, from side. $\times 200$.

Fig. 32. *Psolidium vitreum*, new species.

Knobbed plate from ventral sole. $\times 200$.

Fig. 33. *Psolidium bullatum*, new species.

Knobbed plate from ventral sole. $\times 200$.

Fig. 34. *Protankyra kagoshimensis*, new species.

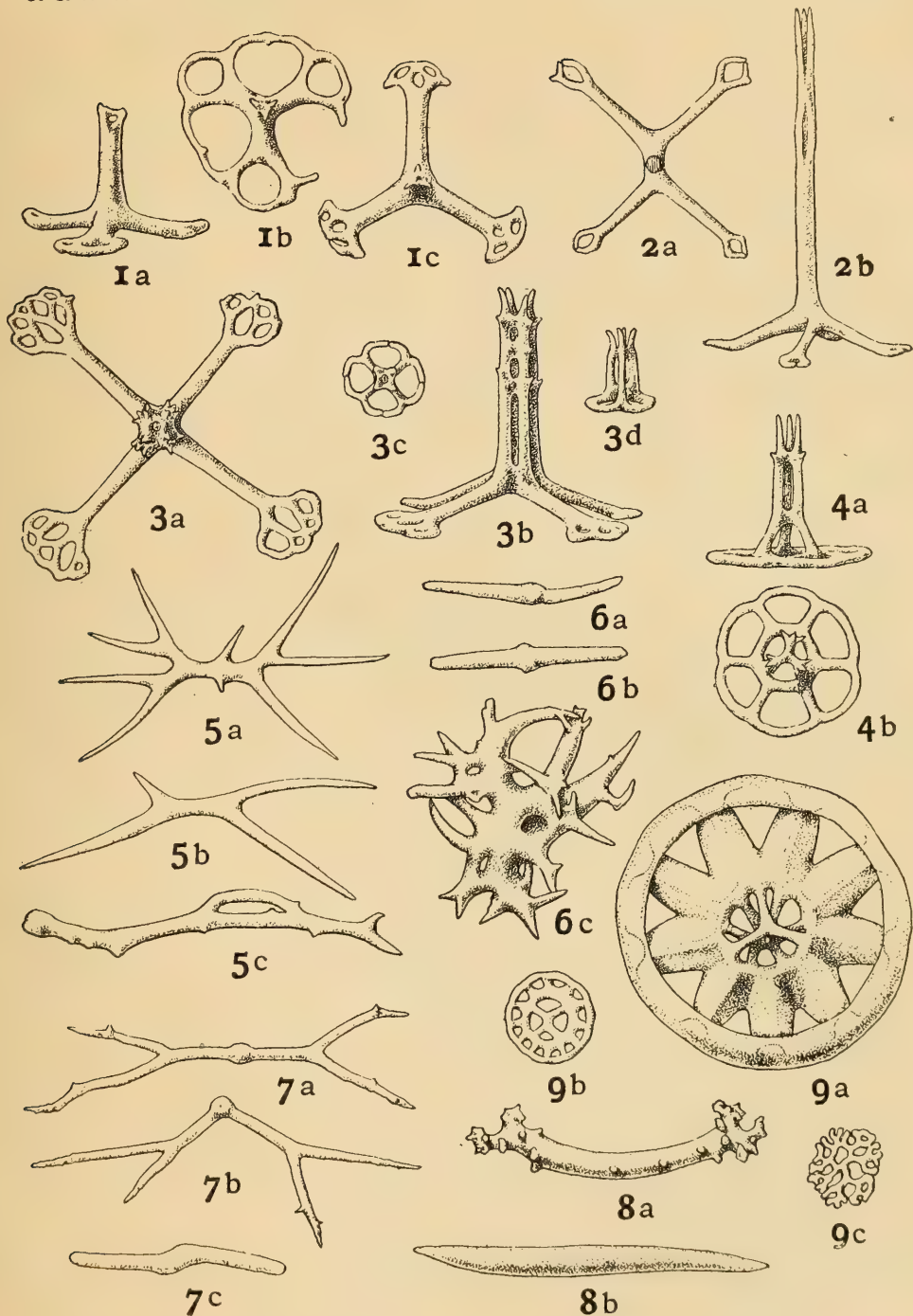
a. Anchor. *b.* Anchor-plate. $\times 80$. *c.* Miliary granules. $\times 200$.

Fig. 35. *Toxodora pacifica*, new species.

Parenthesis-shaped deposits. $\times 300$.

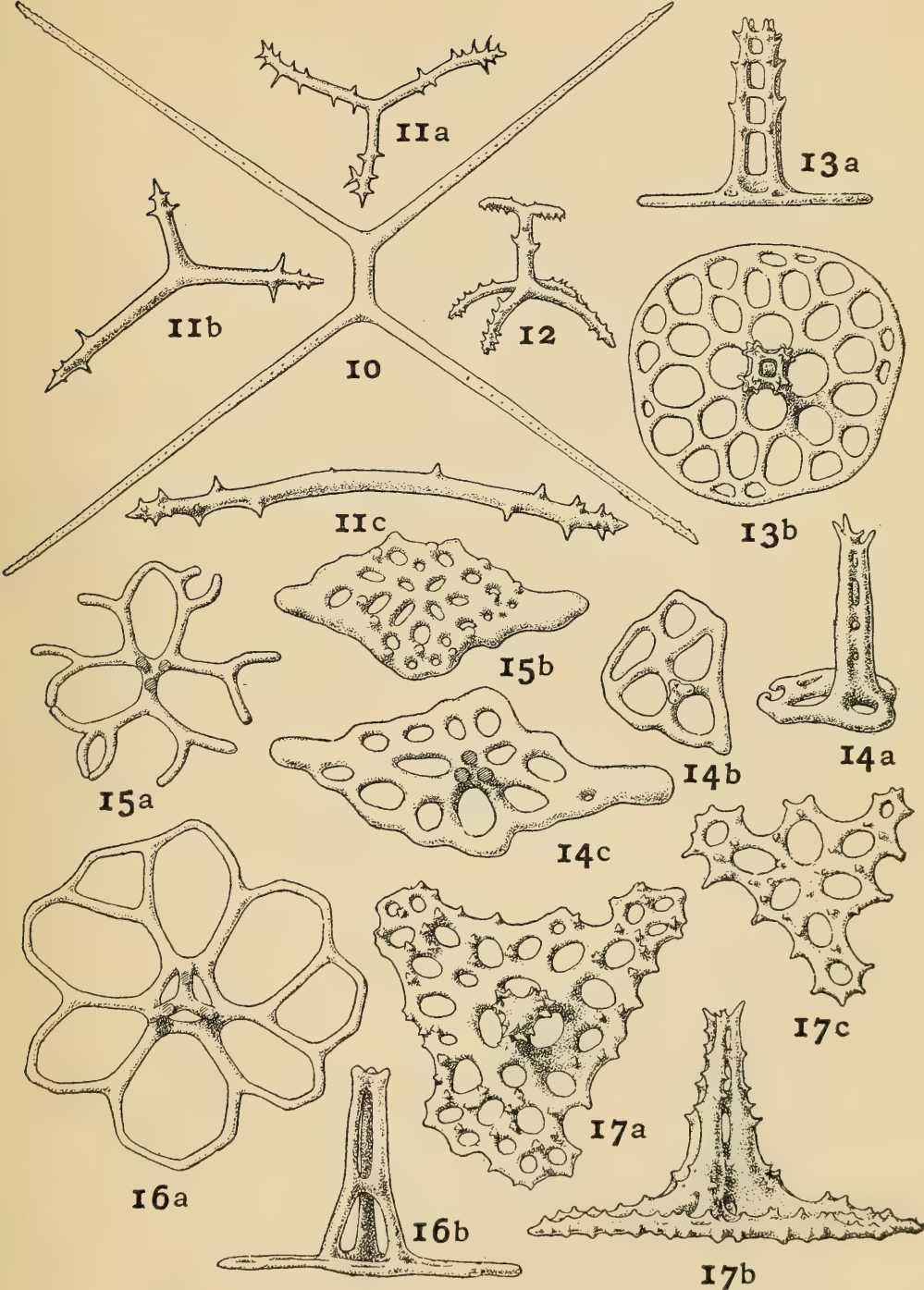
Fig. 36. *Myriotrochus mitsukurii*, new species.

Spinous wheel from tentacle. $\times 200$.



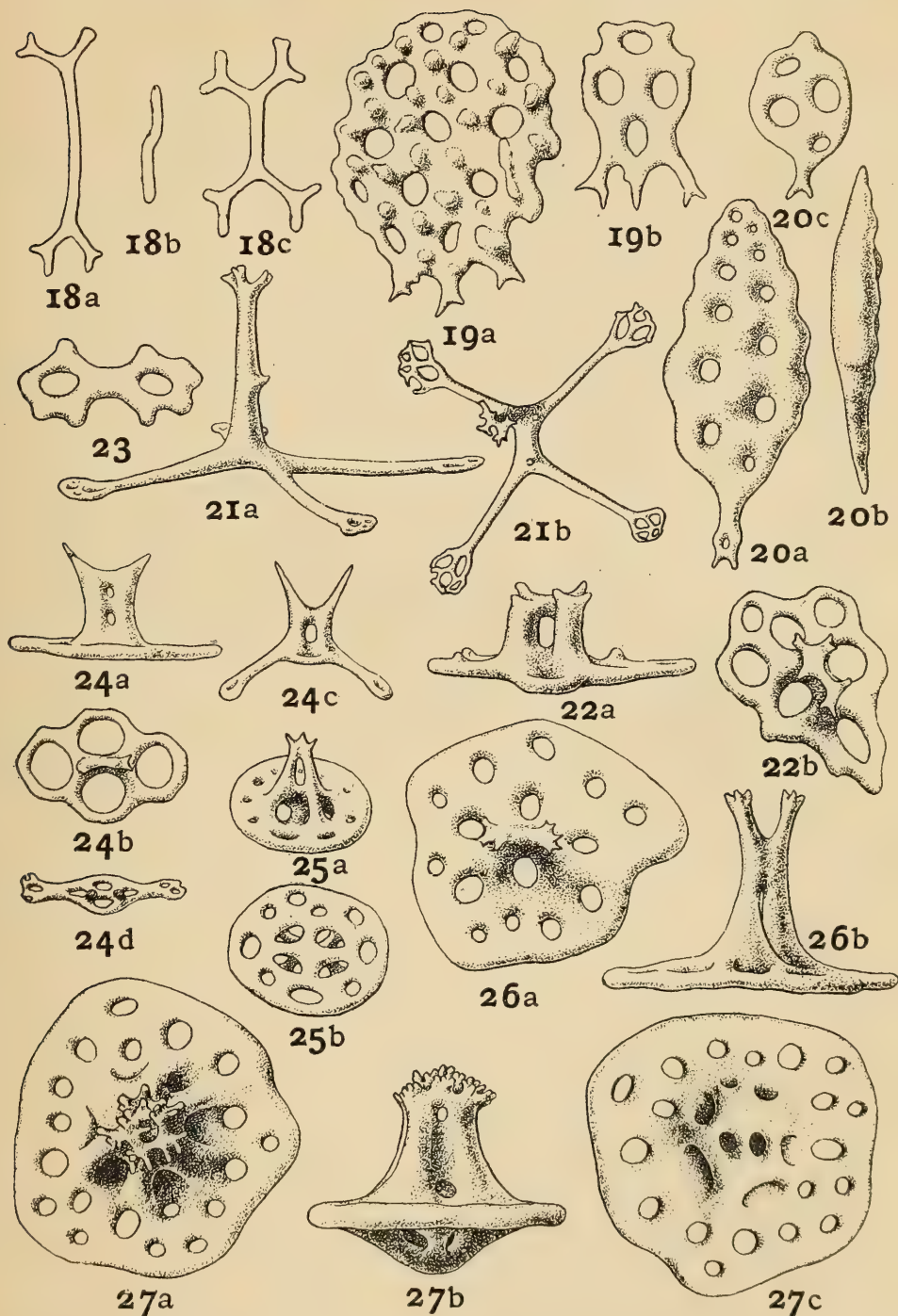
HOLOTHURIANS FROM THE NORTHWESTERN PACIFIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 289.



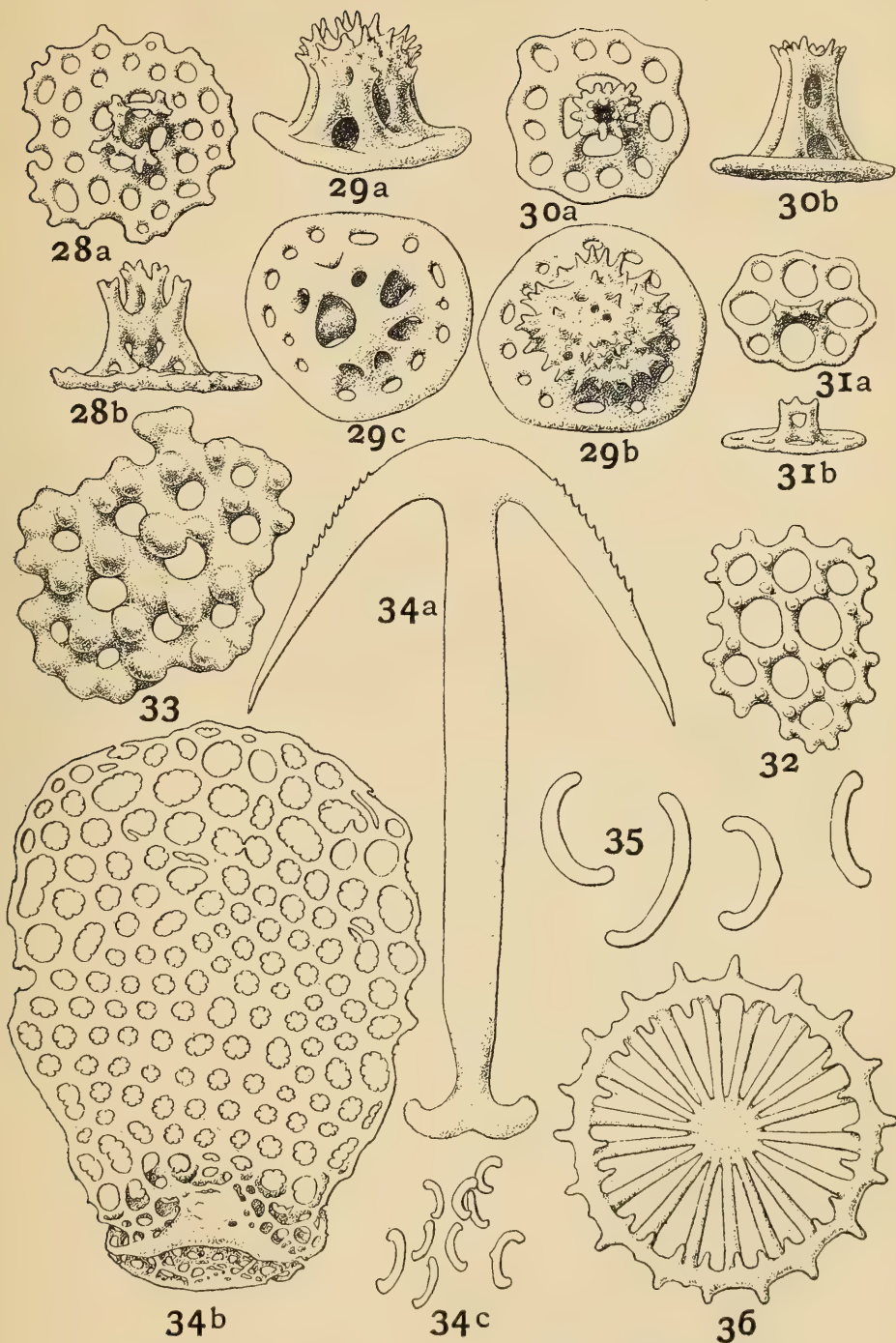
HOLOTHURIANS FROM THE NORTHWESTERN PACIFIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGES 289, 290.



HOLOTHURIANS FROM THE NORTHWESTERN PACIFIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGES 290, 291.



HOLOTHURIANS FROM THE NORTHWESTERN PACIFIC OCEAN.

FOR EXPLANATION OF PLATE SEE PAGE 291.

THE MISSISSIPPI RIVER BLUFFS AT COLUMBUS AND HICKMAN, KENTUCKY, AND THEIR FOSSIL FLORA.

By EDWARD W. BERRY,
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The so-called bluffs which constitute a sharp boundary between the present alluvial plain or bottom of the Mississippi River and the uplands of western Kentucky, Tennessee, and Mississippi usually lie somewhat distant from the present river channel. The mighty father of the waters impinges on this escarpment at the present time both toward the mouth of the Ohio and in southwestern Tennessee. The resulting river bluffs are famed in history and tradition; they have been landmarks for the Indians, the raftsmen, and the packet-boat pilots, and they are not without interest for the physiographer and geologist.

It is the purpose of the present brief contribution to show that the basal beds of the Mississippi Bluffs of western Kentucky at Hickman in Fulton County and in the vicinity of Columbus in Hickman County (the latter known as the Chalk Banks) are of Pleistocene age and not early Eocene as has been supposed by the majority of geologists who have studied the region, and consequently are remnants of a post-Tertiary alluvial plain of the Mississippi River at a considerably higher level than the present Mississippi plain. Also to show that the overlying "bluff gravels" commonly referred to the Lafayette formation are consequently Pleistocene and not Pliocene in age and that they are of fluvial origin.

Without an exhaustive study of the early literature which would be without profit in the present connection it is difficult to say who first studied the Hickman and Columbus Bluffs. Sir Charles Lyell visited the region and makes some interesting suggestions regarding an earlier Mississippi plain about 200 feet above the present one, both in the account of his second visit (vol. 2, chap. 34) and in the fifth edition of his *Manual* (pp. 121-122). David Dale Owen and Leo Lesquereux visited the Chalk Banks, 2 miles south of Columbus, just after the middle of the nineteenth century and were fortunate in discovering and collecting impressions of leaves in the basal portion of the sandy

clays. The section is discussed by Owen in the first volume of the Geological Survey of Kentucky (p. 22) and the plants were briefly described by Lesquereux in the American Journal of Science for 1859 (ser. 2, vol. 27, pp. 364-365).

The following species were enumerated:

<i>Quercus virens</i> (Michaux).	<i>Cænothus americanus</i> ? (Linnæus)
<i>Castanea nana</i> ? (Muhlenburg).	<i>Carya olivæformis</i> (Nuttall).
<i>Ulmus alata</i> ? (Michaux).	<i>Acorus calamus</i> (Linnæus).
<i>Ulmus</i> sp.	<i>Gleditschia triacanthos</i> (Linnæus).
<i>Planera gmelini</i> (Michaux).	Catkins of <i>Alnus</i> or <i>Betula</i> .
<i>Prinos integrifolia</i> (Elliott).	

These are all still existing species and indicated according to Lesquereux that the beds were of Pleistocene age. (See his remarks on this point on pp. 360 and 366).

Many years subsequent to the visit of Owen and Lesquereux, R. H. Loughridge made an exhaustive study of western Kentucky and presented his results in his Report on the Geological and Economic features of the Jackson Purchase Region.¹ Good accounts of both the Hickman and Columbus Bluffs are given, the former in a graphic section on page 38 and the latter on pages 46 and 218. Loughridge mentioned no vegetable remains at the Hickman Bluff except sub-fossil cypress knees in the recent river sediments and regarded the deposits as constituting the oldest known Eocene of the embayment area, giving to them the provisional name of the Hickman group. He mentioned leaves from the Columbus Bluffs, but apparently made no collections and assigned the deposit containing them to the "Lignitic" (roughly corresponding to the Wilcox as now understood).

During the years 1903-1906 L. C. Glenn made a study of this area, his results forming Water Supply Paper No. 164 of the United States Geological Survey. He collected a few fossil plants from the exposure just north of Columbus and discovered and collected fossil plants from the Hickman bluff. These two collections were examined by F. H. Knowlton, who stated² that the Columbus collection contained two species of *Quercus* and a species of *Salix*; the Hickman collection "a *Salix*, *Menispermum canadense* L., and *Tecoma radicans* L., or something near it." Both deposits were regarded as of Pliocene age. Glenn, while he recognized the possibility of these leaf-bearing beds being younger than the Wilcox, placed them in the upper part of that division of the Eocene, concluding that he did not have "sufficient stratigraphic evidence for such a separation." The present writer did not have an opportunity of visiting these outcrops until the summer of 1913. While there is considerable variation in the height of the bluffs and in the lithologic character of the beds, the following some

¹ Geol. Surv. Ky., 1888.

² Water Supply Paper No. 164, p. 38.

what generalized sections will aid the reader in understanding the relations.¹

About one-eighth of a mile above Columbus the bluff is nearly 200 feet high and shows the following sequence of materials

	Feet.
1. Loess apparently grading into the underlying member.	50-60
2. Yellowish to brownish ferruginous sand, often indurated, grading downward into a heavy gravel with some cobbles, often indurated to form great masses of conglomerate, the lower one-third to one-half of the member conglomeratic.	the whole.. 40-50
3. Gray sandy alluvial-looking laminated to massive siliceous leaf-bearing clay, toward the north in places a pink slightly sandy plastic clay.	about.. 80

Southward a quarter of a mile and just north of the town the basal portion of the bluff is made up of coarse angular somewhat silty, loose, very crossbedded sand, carrying pellets and some laminæ one to three inches thick of grayish clay. These sands are prevailingly gray with some ferruginous brown streaks and become finer and more argillaceous upward. The clays appear at first silty and drab but bleach to almost white and become indurated upon exposure and the leaf substance, represented by ulmic, humic or ferruginous materials, is leached out, leaving only faint impressions. In places the leaves form matted layers exactly comparable with those found in recent river deposits.

At the Chalk Banks, 2 miles south of Columbus, the section is also variable and has been much cut and slumped since the days of Owen and Lesquereux. Following is a somewhat generalized section at the latter locality:

	Feet.
1. Loess more or less covered.	60-80
2. Compact ferruginous heavy gravel in a coarse sand.	10-15
3. Yellowish iron-stained slacked clay grading downward into next member	about.. 10
4. Gray clay with considerable fine white sand, generally thickly laminated and sparingly leaf bearing.	about.. 50

At Hickman the bluff is about 185 feet above low water. The following section is somewhat generalized since there is considerable lateral variation:

	Feet.
1. Loess.	about.. 65
2. Heavy gravel.	10-15
3. Gray siliceous micaceous leaf-bearing clay with calcareous concretions becoming more sandy and softer toward the base.	about.. 105

This lower 105 feet is obviously a formational unit, although Glenn separates the softer basal 30 feet from the overlying 75 feet. The clays are very unevenly laminated; where they are more sandy and thinly laminated they contain more water, are darker in color, and the leaf impressions are better preserved—where they are less sandy and more massive, they are lighter in color, more indurated and the

¹ As previously mentioned, detailed sections have been given by Owen and Loughridge, but as the river is cutting rapidly the exposures change from year to year.

leaf impressions are very faint. The latter materials are almost exactly like those in the Columbus Bluffs. In several years field study of the Wilcox, from Alabama to Texas, the writer has never seen Wilcox materials at all like those in the Hickman and Columbus Bluffs, while on the other hand the materials are very similar to those of numerous Pleistocene leaf-bearing river terraces from North Carolina to Mississippi. The leaf impressions are the same in all of these sections, those found at each outcrop being recorded in the following annotated list. All but two represent still existing species with climatic requirements very similar to those still growing in this same area. A consideration of this list leads inevitably to the conclusion that these outcrops are entirely of Pleistocene age and of fluvial origin. This being true the heavy gravels commonly referred to the Lafayette formation that overlie the leaf-bearing clays are also Pleistocene and not Pliocene and are likewise fluvial in origin as they are also in character. A transgressing sea forming a blanket deposit shapes pebbles differently in beach shingle. How far eastward from the present river this earlier and Pleistocene alluvial deposit extends it is hard to state definitely, since exposures are infrequent and the problem would require extended field studies. Probably they did not extend very far, since the bluffs northward at Wickliffe, Kentucky, carry plant fossils and are unquestionably of Wilcox age and those between Memphis and Randolph, Tennessee, likewise fossiliferous, are of upper Eocene age. There are some well records at Hickman, but they are too indefinite to show the contact with the Wilcox, which, however, is demonstrated to underlie the outcropping Pleistocene.

Following is an enumeration of the forms collected:

Order CONIFERALES.

Family PINACEAE.

Genus TAXODIUM L. C. Richard.

TAXODIUM DISTICHUM (Linnaeus) L. C. Richard.

Taxodium distichum (LINNAEUS) Richard, HOLMES, Journ. Elisha Mitchell Soc. for 1884-85, 1885, p. 92.—HOLLICK, Md. Geol. Surv. Pli. and Pleistocene, 1906, pp. 218, 237, pl. 68.—BERRY, Torreyia, vol. 6, 1906, p. 89; Journ. Geol., vol. 15, 1907, p. 339; Amer. Nat., vol. 43, 1909, pp. 432, 433, 434, figs. 1, 2; Torreyia, vol. 10, 1910, p. 263; Amer. Journ. Sci., ser. 4, vol. 29, 1910, p. 391; Plant World, vol. 14, 1911, pp. 39-45, figs. 1, 2.

The remains of the bald cypress are very common in American Pleistocene deposits from New Jersey and Maryland southward, where they are represented by the deciduous twigs, conescales, seeds, aments, and stumps with the characteristic "knees."

A single twig was found associated with the other plant remains in the clays at Hickman, this rarity apparently indicating that the cypress was not abundant in the immediate vicinity or up the river at the time these clays were deposited.

Order JUGLANDALES.

Family JUGLANDACEAE.

Genus HICORIA Rafinesque.

HICORIA PECAN (Marsh) Britton.

Carva olivaeformis Nuttall, LESQUEREUX, Amer. Journ. Sci., ser. 2, vol. 27, 1859, p. 365.

Both leaflets and nuts were recorded by Lesquereux from the Chalk Banks near Columbus in 1859. I found no nuts, but the leaflets are very common in the bluffs both north and south of Columbus and sparingly represented at Hickman. One specimen collected showed the terminal and two pairs of lateral leaflets attached to the rachis. This occurrence would seem to lend considerable weight to the theory advanced by Mohr and others that the pecan is indigenous in the eastern Gulf region.

HICORIA GLABRA (Miller) Britton.

Carya porcina Nuttall, MERCER, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 11, 1899, pp. 277, 281, figs. 4, 5, 8, 12, 16.

Hicoria glabra (Miller) Britton, BERRY, Torreyia, vol. 6, 1906, p. 89; Journ. Geol., vol. 15, 1907, p. 340; Torreyia, vol. 9, 1909, p. 97, figs. 1-5; vol. 10, 1910, p. 264, fig. 1.

The pignut hickory has been recorded from a number of Pleistocene localities in New Jersey, Pennsylvania, Maryland, Virginia, and North Carolina, being represented by nuts, husks, and leaves. A characteristic large terminal leaflet was found at Hickman and a less certainly identified lateral leaflet was collected at Columbus.

This species is, with the exception of the pecan, our most southerly ranging hickory, reaching its present maximum development in the lower Ohio River basin, and it is certainly significant in its bearing on local Pleistocene climates that these two species should be found fossil in western Kentucky.

Order SALICALES.

Family SALICACEAE.

Genus SALIX Linnaeus.

SALIX VIMINALIFOLIA, new species.

Leaves linear-lanceolate in outline, of relatively large size, about 15 cm. in length by 2.25 cm. in maximum width, gradually narrowed to the acuminate tip and somewhat abruptly narrowed to the broadly cuneate base. Margins entire in all of the specimens collected. Venation typical of *Salix*.

The present species is named from its resemblance to the leaves of the existing *Salix viminalis* Linnaeus, from which, however, it is perfectly distinct, as it seems to be also from existing American species of *Salix*. It is represented by three specimens from Hickman and is present in considerable abundance in the late Pleistocene of North Carolina.

Type.—Cat. No. 34963, U.S.N.M.

Genus **POPULUS** Linnaeus.

POPULUS, species.

Characteristic staminate aments of a species of *Populus* are not uncommon in the clays at Hickman. They are 3 or 4 inches long and probably represent either *Populus heterophylla* Linnaeus or *Populus deltoides* Marsh, presumably the latter species, since they are hardly stout enough to be referred to the former. They are not well enough preserved to show the details of their organization, but they do show clearly the bracts and the subtended masses of stamens.

Order **FAGALES**.

Family **BETULACEAE**.

Genus **BETULA** Linnaeus.

BETULA NIGRA Linnaeus.

Betula nigra Linnaeus, KNOWLTON, Amer. Geol., vol. 18, 1896, p. 371.—BERRY, Journ. Geol., vol. 15, 1907, p. 341; Amer. Nat., vol. 41, 1907, p. 692, pl. 2, figs. 2-4; vol. 43, 1909, p. 435; Amer. Journ. Sci., ser. 4, vol. 29, 1910, p. 393.

The river birch is not uncommon in our fluvial Pleistocene deposits, having been already recorded from West Virginia, Virginia, North Carolina, Georgia, and Alabama. It is represented by leaves in the Hickman Bluff. In the existing flora it is a distinctly mesophytic type of stream and lake borders with a wide range extending from Massachusetts to Iowa and southward to Florida and Texas.

BETULA, species.

The lignified remains of catkins are very common both at Columbus and Hickman. Similar remains were collected by Owen and Lesquereux from the Chalk Banks below Columbus and were referred to by the latter author as "catkins of *Alnus* or *Betula*"¹. After careful comparisons I have concluded that they represent the mature pistillate catkins of *Betula*, which, although the scales are normally deciduous, often remain intact, especially if not thoroughly mature and dry, and are readily preserved in river muds.

¹ Lesquereux, Amer. Journ. Sci., ser. 2, vol. 27, 1859, p. 365.

Family FAGACEAE.

Genus FAGUS Linnaeus.

FAGUS AMERICANA Sweet.¹

Fagus ferruginea Aiton, KNOWLTON, Amer. Geol., vol. 18, 1896, p. 371.—MERCER, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 11, 1899, pp. 277, 281, fig. 8¹⁵.

Fagus americana Sweet, HOLLICK, Md. Geol. Surv., Pl. and Pleist., 1906, p. 226.—BERRY, Torreya, vol. 6, 1906, p. 88; Journ. Geol., vol. 15, 1907, p. 341; Amer. Nat., vol. 41, 1907, p. 692, pl. 2, fig. 7; vol. 43, 1909, p. 435; Amer. Journ. Sci., ser. 4, vol. 29, 1910, p. 393.

The beech is widely distributed in the fluvial Pleistocene deposits of the Southern States, where it is commonly represented by nuts and husks as well as leaves. Leaves are sparingly represented at the Columbus Bluff. In the existing flora the beech is a common river-bottom type ranging from southern Canada to Florida and Texas.

Genus QUERCUS Linnaeus.

QUERCUS, species.

Two lignitized acorns were collected from the clays of the Columbus Bluff. Although exact determination has not been attempted, they obviously represent a recent species and strongly suggest those of *Quercus alba* Linnaeus.

Order URTICALES.

Family ULMACEAE.

Genus ULMUS Linnaeus.

ULMUS ALATA Michaux.

Plate 12, fig. 6.

Ulmus alata Michaux, LESQUIREUX, Amer. Journ. Sci., ser. 2, vol. 27, 1859, p. 565.—BERRY, Journ. Geol., vol. 15, 1907, p. 343; Amer. Nat., vol. 41, 1907, p. 694, pl. 1, figs. 6, 7; Amer. Journ. Sci., ser. 4, vol. 29, 1910, p. 396.

This species was recorded by Lesquereux from the Chalk Banks near Columbus in 1859. It has since been recorded from the late Pleistocene of North Carolina and Alabama. Characteristic leaves of this species are common in the clays at Hickman. The specimen figured, however, is not typical and is of questionable identity.

In the existing flora this species ranges from southern Virginia to southern Illinois and southward to Florida and Texas, hence the fossil occurrence at Hickman is near the northern limit of its present range.

¹ The latest name of the systematists for this species is *Fagus grandifolia* Ehrhart.

Genus *PLANERA* J. F. Gmelin.*PLANERA AQUATICA* (Walter) J. F. Gmelin.

Planera gmelini Michaux, LESQUEREUX, Amer. Journ. Sci., ser. 2, vol. 27, 1859, p. 365.

Planera aquatica (Walter) Gmelin, BERRY, Journ. Geol., vol. 15, 1907, p. 343.

Leaves of water elm were recorded by Lesquereux from the Chalk Banks near Columbus in 1859 and more recently they have been found in the late Pleistocene river terraces (Chowan formation of North Carolina. They are included in the present collections from both Hickman and Columbus.

In the existing flora this species, which inhabits swamps and river bottoms, ranges from North Carolina and southern Indiana southward to Louisiana and Florida.

Order RANALES.

Family MENISPERMACEAE.

Genus *CEBATHA* Förskal.*CEBATHA CAROLINA* (Linnaeus) Britton.

Plate 12, figs. 3-5.

Menispermum carolinum LINNAEUS, Sp. Pl., 1753, p. 340.

Cebatha carolina (Linnaeus), BRITTON, Mem. Torrey Bot. Club, vol. 5, 1894, p. 162.

Menispermum canadense Linnaeus, KNOWLTON in Glenn, Water Supply Paper No. 164, 1906, p. 38.

The present species, which is a slender vine, ranges from Virginia to Illinois and Kansas and southward to Florida and Texas, inhabiting stream banks and thickets bordering woodlands. The genus to which it belongs contains about 30 species, all perennial climbers, the majority confined to the tropical regions of both hemispheres. The present species has not been heretofore found in the Pleistocene to the writer's knowledge, although various members of the family are known as far back as the middle Cretaceous.

Large and small leaves are present in considerable abundance at both Hickman and Columbus.

Order SAPINDALES.

Family ILICACEAE.

Genus *ILEX* Linnaeus.

ILEX (?), species.

Plate 12, fig. 2.

The single small leaf figured, which is tentatively referred to the genus *Ilex*, was found at Hickman.

Order UMBELLALES.

Family CORNACEAE.

Genus NYSSA Linnaeus.

NYSSA SYLVATICA Marsh.

Leaves of this species, which apparently has not hitherto been recorded from the Pleistocene, were collected at Hickman. In the existing flora it is often confused with *Nyssa biflora* Walter, and the latter species is of frequent occurrence in the late Pleistocene (Talbot formation and its equivalents) from New Jersey southward. *Nyssa sylvatica* is a low woods and swamp type ranging from Maine and Michigan southward to Florida and Texas.

Order ERICALES.

Family ERICACEAE.

Genus XOLISMA Rafinesque.

XOLISMA LIGUSTRINA (Linnaeus) Britton.

Plate 12, fig. 1.

Xolisma ligustrina (Linnaeus) Britton, HOLLICK, Md. Geol. Surv., Pli. and Pleist., p. 236, 1906, pl. 69, fig. 6.—BERRY, Journ. Geol. vol. 15, 1907, p. 346; Amer. Nat., vol. 41, 1907, p. 696, pl. 2, fig. 6; Amer. Journ. Sci., ser. 4, vol. 29, 1910, p. 398.

This species, represented by leaves in the Hickman Bluff, has been previously recorded from the late Pleistocene of Maryland, North Carolina, and Alabama. In the existing flora it is an inhabitant of swamps and wet places ranging from New England to Florida and west to Arkansas, so that its fossil occurrence at Hickman is north of its present northern limit in the Mississippi Valley.

Order GENTIANALES.

Family OLEACEAE.

Genus FRAXINUS Linnaeus.

FRAXINUS AMERICANA Linnaeus.

This species has apparently not been found before in the fossil state. It is represented by leaves at the Hickman Bluff. In the existing flora it ranges from Nova Scotia to Minnesota and southward to Florida and Texas. Its habitat is rich, usually moist woodland near streams, and it is said to reach its maximum size in the bottom lands of the lower Ohio River.

Order POLEMONIALES.

Family BIGNONIACEAE.

Genus TECOMA Jussieu.

TECOMA PRERADICANS, new species.

Plate 13, figs. 1-5.

Leaves odd pinnate, not tendril bearing, of five or more sessile leaflets. No complete leaves have been found, but from the small size of the basal pair of leaflets in specimens showing five leaflets it seems safe to assume that the normal number was from five to seven. Leaflets lanceolate to ovate or obovate in outline, ranging from 2 cm. to 7 cm. in length and from 1 cm. to 4.5 cm. in maximum width. Terminal leaflet equilateral, the base decurring to a pseudo-petiolule. Lateral leaflets slightly inequilateral. Bases and tips about equally pointed. Margins entire for about one-third of the distance upward; above this they are beset with somewhat irregular, prominent, upwardly directed serrate teeth. Midribs relatively stout. Secondaries stout, numerous; about nine opposite to alternate pairs diverge from the midrib at angles averaging about 45° , curving slightly upward, almost regularly spaced, subparallel and craspedodrome.

The present species is similar to the existing *Tecoma radicans* in general appearance, and specimens collected by Glenn at Hickman were identified by Knowlton¹ as this species or something near it. It differs from the existing species in the fewer leaflets, the latter species having usually 9 to 13, and extended search has not brought to light leaves with fewer than seven leaflets. Other differences shown by the fossil are its smaller and more close-set marginal teeth, the tendency of the leaflets to assume an obovate outline, and the absence of the produced acumen that characterizes the leaflets of the trumpet-creeper. The secondaries are also more uniformly craspedodrome in the fossil form.

Tecoma preradicans occurs at both the Columbus and Hickman Bluffs, being exceedingly common at the latter locality. The genus *Tecoma* consists of about 80 species of the Temperate and Tropical Zones of both hemispheres. They are massed in the Brazilian region. Two species extend into the United States. One of these, *T. stans*, made the type of the genus *Stenolobium* Don by Small, ranges from Florida to Mexico and tropical America, the other, *T. radicans*, made the type of the genus *Campsis* Loureiro by Small, ranges northward to southern New Jersey along the Atlantic coast and to southern Illinois in the Mississippi Valley.

¹ In Glenn, Water-Supply and Irrigation Paper, No. 164, p. 38.

The proportion of still existing species and the occurrence of one of the two fossil species, i. e., *Salix viminalifolia*, in the late Pleistocene (Chowan formation) of North Carolina would seem to indicate that the deposits of the Hickman and Columbus Bluffs are of late Pleistocene age, but since the range of both existing and fossil plants in the Pleistocene is so imperfectly known this is not demonstrated. Since a majority of the forms recorded are prevailingly southern forms, and several, as *Ulmus alata*, *Planera aquatica*, *Cebatha carolina*, *Xolisma ligustrina*, find their present northern limit near the latitude of Columbus, it follows that the climate was not very different as regards rainfall and temperature from that of the present in western Kentucky. This is also indicated by the fact that several of these species attain their maximum development at the present time in the lower valley of the Ohio. It is obvious that this flora is preglacial, interglacial, or postglacial in age, which is as definitely as it can be correlated until more extensive data are available for comparison.

Although I regard it as younger, there is a possibility that the flora of the Hickman and Columbus Bluffs may be contemporaneous with an extensive flora, as yet undescribed, from southern Alabama and Mississippi, that I have considered to be of late Pliocene or early Pleistocene, probably the former, age. In the absence of Pliocene floras for comparison the question is rendered very complex.

The question of exact age of late Tertiary and Quaternary floras is still further complicated by the uncertainty as to when the Pliocene ended and the Pleistocene began. Like the comparable question of the boundary between the Pleistocene and the Recent, it is dependent almost entirely upon latitude. Until the whole subject can be considered in a philosophical and comprehensive way and in the light of a far greater array of facts than are at present available, any extended discussion is futile. Certainly as the term is ordinarily understood the flora of the Hickman and Columbus Bluffs is Pleistocene.

Types.—Cat. Nos. 34964–34968, U.S.N.M.

EXPLANATION OF PLATES.

PLATE 12.

Fig. 1. *Xolisma ligustrina* (Linnaeus) Britton.

2. *Ilex*, species.

3–5. *Cebatha carolina* (Linnaeus) Britton.

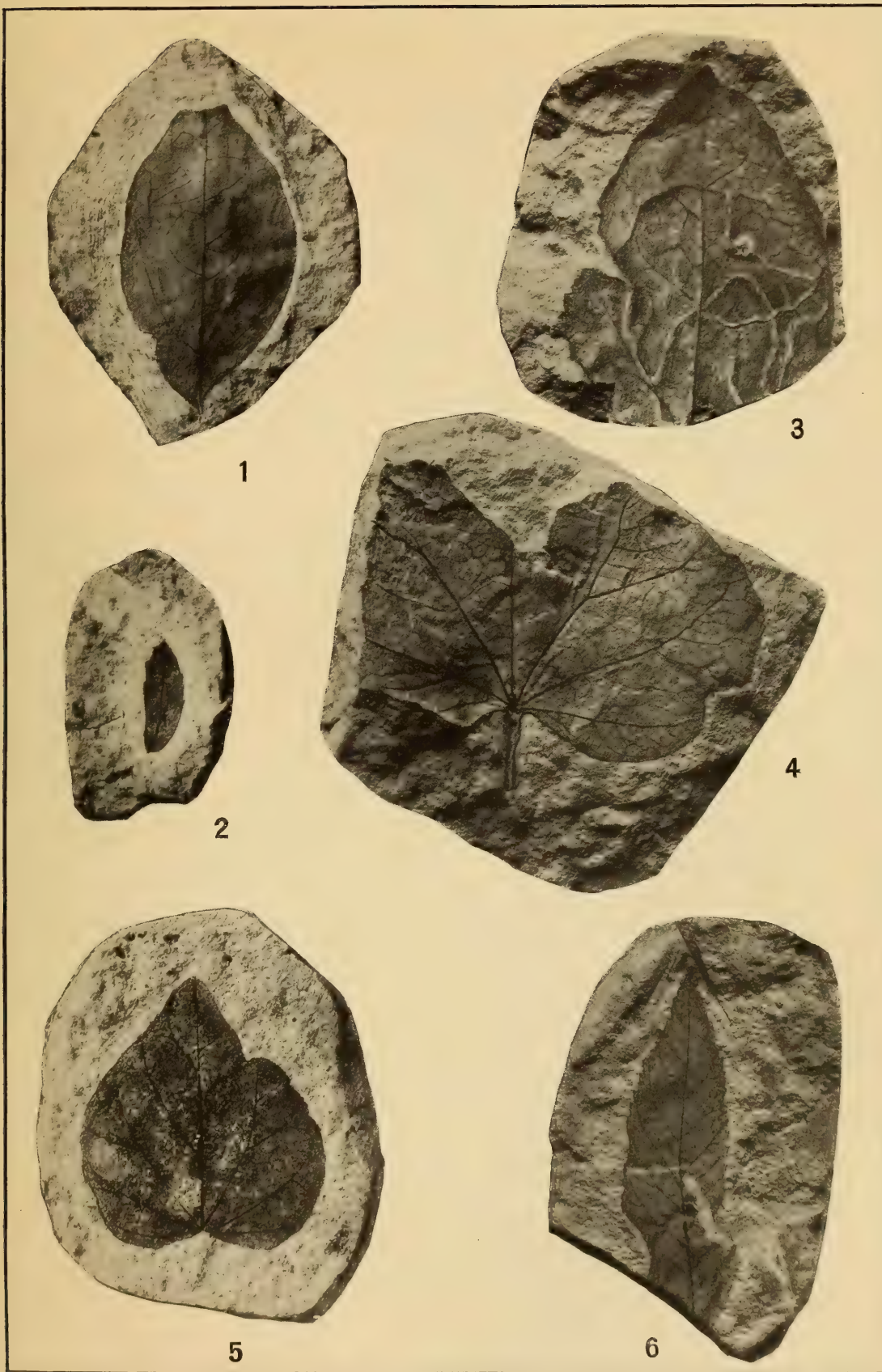
6. *Ulmus alata* Michaux.

All from the early Pleistocene of Hickman, Ky.

PLATE 13

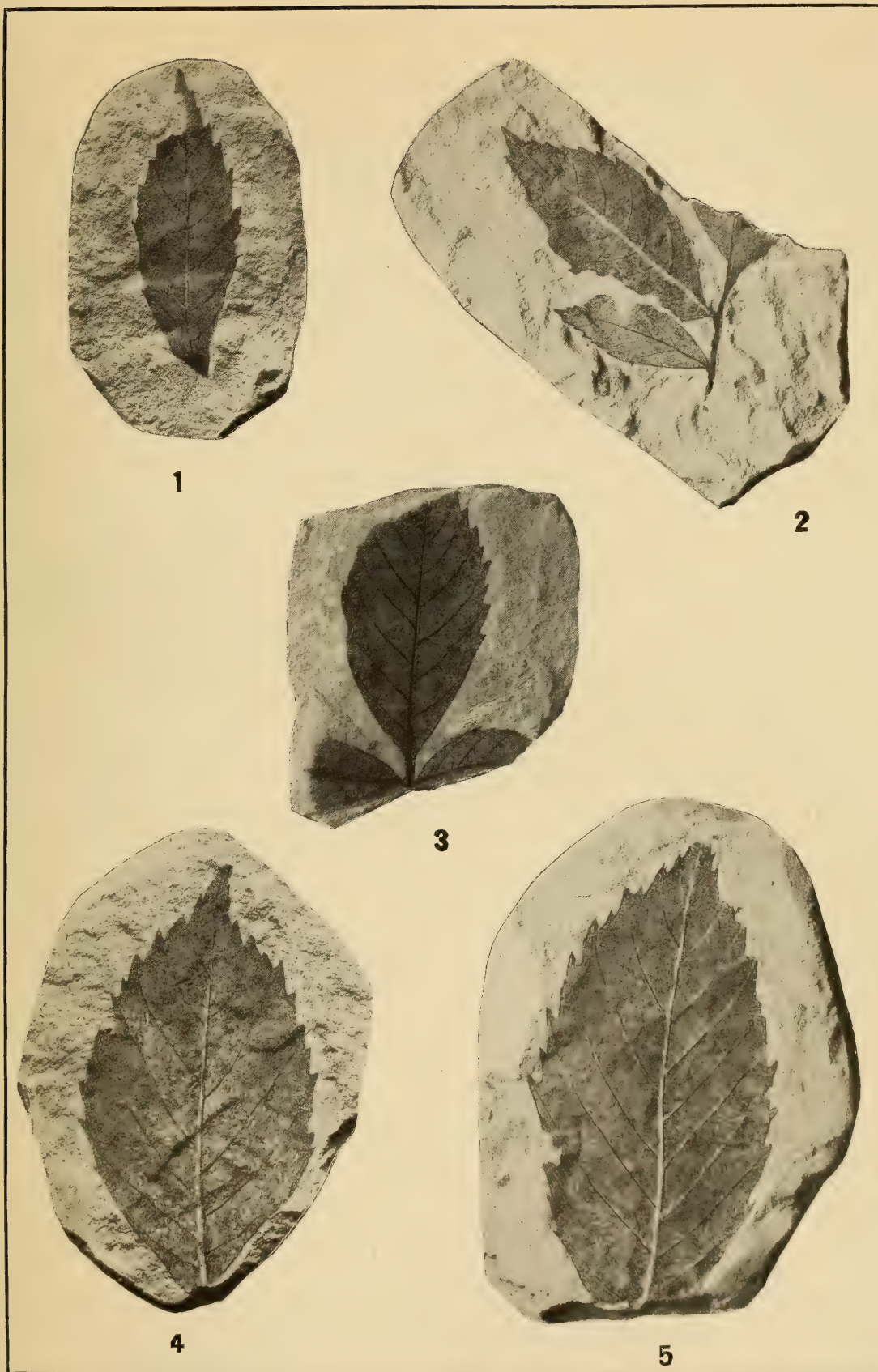
Figs. 1–5. *Tecoma preradicans*, new species.

Early Pleistocene of Hickman, Ky.



FOSSIL FLORA FROM THE MISSISSIPPI RIVER BLUFFS.

FOR EXPLANATION OF PLATE SEE PAGE 303.



FOSSIL FLORA FROM THE MISSISSIPPI RIVER BLUFFS.

FOR EXPLANATION OF PLATE SEE PAGE 303.

FISHES COLLECTED BY THE UNITED STATES FISHERIES
STEAMER "ALBATROSS" IN SOUTHERN CALIFORNIA
IN 1904.

By CHARLES HENRY GILBERT,
Of Stanford University, California.

During the spring and summer of 1904 the *Albatross* was detailed for bathybial investigations in southern California. An extensive series of dredgings were taken in the San Diego region, and another in Monterey Bay, the two being connected by a third series, taken at intervals along the intervening stretch of coast. The fishes obtained form the basis of the present paper, the following genera and species being described as new:

Raja montereyensis.

Xenognathus, new genus (Alepocephalidae).

Xenognathus profundorum.

Lampanyctus ritteri.

Zastomias, new genus (Stomiatidae).

Zastomias scintillans.

Melamphaës bispinosus.

Melamphaës nycterinus.

Sebastodes wilsoni.

Icelinus fuscescens.

Asterotheca, new genus (Agonidae).

Xenopyxis, new subgenus (Agonidae).

Xeneretmus leiops.

Xeneretmus ritteri.

Paraliparis caudatus.

Paraliparis albescens.

Lipariscus, new genus (Liparididae).

Lipariscus nanus.

Embryx parallelus.

Maynea californica.

Lycogramma, new genus (Zoarcidae).

Bothrocara remigera.

Lycodapus mandibularis.

Lycodapus lycodon.

Lycodapus attenuatus.

Lycodapus grossidens.

Nematonurus abyssorum.

Monoceratias, new genus (Ceratiidae).

Monoceratias acanthias.

RAJA INORNATA Jordan and Gilbert.

Station 4452, Monterey Bay, 49-50 fathoms.

An embryo in the egg case with yolk about two-thirds absorbed, and a young specimen 180 mm. long were secured from this station.

In the embryo, the contour of the snout is very broadly rounded, the extreme tip abruptly protruding. None of the spines are yet free but the primary spines can be made out recumbent beneath the integument. Two in front of eye and one on posterior superior orbital rim are evident. And on the median line of back, an unbroken series extends from the posterior edge of branchial area to the first dorsal fin. The anterior three of these are hard and spinous, and longer than those which follow, the third somewhat weaker than the first two. The fourth and fifth are small, weak, and flexible, and the remainder of the series are hard and spinous, though smaller than the anterior three. In the freshly hatched young the three primary ocular spines appear and are for a time the only spines present on the orbital margin. Later, the number is increased through the intercalation of secondary spines.

We have no postembryonic specimens showing an uninterrupted series along back. The first three typically appear, though occasionally only the first two are present, then follows an interval where were found in the embryo the rudiments of two or three weaker spines; and finally, beginning opposite the anterior ventral lobe, the remainder of the series. It is not known whether the weak fourth and fifth spines of the series fail to break through or whether after doing so they retrograde.

RAJA RHINA Jordan and Gilbert.

List of stations.

4365	Near San Diego.....	<i>Fathoms.</i> 130-158
4452	Monterey Bay.....	49- 50

Three young specimens, 170 to 225 mm. long.

As stated by Starks,¹ the young of *R. inornata* and *R. rhina* are difficult to separate, as the characteristic form of the disk in *R. rhina* has not yet developed, and the spines and color are then very similar. A difference in the primary spines seems, however, constant and diagnostic. In our youngest specimens the orbital spines are distinctly larger than in *R. inornata*, and the anterior of the median dorsal series is always very strong and single, a wide gap separating it from the succeeding spines of the series. In *R. inornata* the anterior dorsal spines are smaller and are always present in a series of three (or rarely two). There are in this collection no embryos of *R. rhina* which

¹ Ann. Carnegie Mus., vol. 7, 1911, p. 172.

would permit us to determine whether the median row of the back are laid down as a continuous series, as in *R. inornata*. But three embryos from a previous collection (station 3106, off San Francisco Bay, 77 fathoms) seem to throw light on this question. They are 120, 125, and 145 mm. long, and all agree in having the rudiments of the dorsal spines distinctly shown and in having an area along the middle of the back between the anterior of the series and the base of the ventrals in which no rudiments are present. These specimens were identified in a former communication as *R. inornata*,¹ and an attempt was made without success to trace in older specimens of *R. inornata* the supposed development of the spines in the gap as a secondary growth. It seems now, however, that these were the young of *R. rhina*, in which the gap is a primitive feature, while in *R. inornata* the series is primitively complete and the gap develops by the later suppression of a few of the intermediate spines.

RAJA MONTEREYENSIS, new species.

Plate 14, fig. 1.

Type-specimen.—Cat. No. 75806, U.S.N.M., a young female, 198 mm. long, from station 4531, Monterey Bay, off Santa Cruz, California, depth 26–28 fathoms.

Probably most nearly related to *R. inornata*, differing widely from *R. inornata*, *rhina*, and *binoculata* in having the entire upper surface of the disk, except its posterior margin, covered with rather coarse prickles, which are coarsest near the mid-dorsal line, and grow finer toward the periphery. In *R. inornata*, *rhina*, and *binoculata* of this size no prickles whatever are present. In addition to the prickles, *R. montereyensis* has a series of spines on the orbital margin and an uninterrupted series of strong spines along the median line of back and tail. The anterior spine of the dorsal series occupies, as usual, a definite position between the diverging posterior ends of two series of pores which lie on either side the median line behind the occiput. The first three spines of the series are stronger than those which follow. The total number is 32, all in advance of the first dorsal fin. Area between the dorsals smooth. The orbital spines are arranged as in *R. inornata*, *rhina*, and *binoculata*. Three primary spines are distinguishable; two are in advance of the eye, one directed inward and backward, the other outward and backward; the third above the posterior margin of the orbit, directed outward and backward. These three, as well as the series of dorsal spines, doubtless here as well as in related species, are definitely formed in the late embryo, and are evident as soft papillæ beneath the integument long before the absorption of the yolk. In the type two secondary spines have been formed in the orbital series, one above the middle of the eye, the other poste-

¹ Report U. S. Fish Comm. for 1893 (1896), p. 463.

riorly above the spiracle. The presence of these secondary spines and the prickles, as well as the general texture and appearance, seem to indicate that this is a small species, with the type much older than would be the case in a specimen of the same size of *R. inornata*, *rhina*, or *binoculata*. No spines on shoulder. Lower side of disk smooth.

The disk is broadly rounded, 107 mm. long from tip of snout to posterior point of attachment of the ventral fins, 92 mm. to posterior base of pectorals; its greatest width 136 mm. Its width, therefore, is half greater than the length to posterior base of pectorals. The line joining the outer angles of disk passes through the middle of the ocellated spots and over the third spine of the dorsal series at a point midway between the tip of the snout and the posterior margin of the ventrals. The outer angle of disk is broadly rounded and the antero-lateral margins slightly undulated but convex, a line from tip of snout to outer angle being everywhere included within the margin of the disk. The snout is short and convex, the tip a trifle protruding, the rostral cartilages firm, converging forward, and meeting immediately behind the tip of snout. Length of snout from front of orbit 27 mm., interorbital width of spiracle 5 mm., of mouth between lateral folds 18 mm., distance from tip of snout to nostril 23 mm. Length of tail behind disk 91 mm.

Color light brown, indistinctly mottled, and with a few scattered small dark spots. A large, conspicuous, narrow black ring on middle of pectoral base, surrounding an area of the ground color and with a dark central spot. Directly behind this, separated by half the diameter of the ring, a conspicuous small white spot. Two faint dark cross-bars on interorbital area and one on base of snout. Lower surface light, unmarked.

The species differs widely from the group typified by *stellulata* and *parmifera* by the strong rostral cartilages and the presence of a series of (primary and secondary) orbital spines. The authorities of the United States National Museum have kindly permitted the writer to reexamine the type of *Raja equatorialis*, known from a single male specimen taken near Panama. It has the upper surface of the disk without coarse prickles. All the spines are very small, those in the middle of the dorsal series, over the posterior half of the pectorals, greatly reduced, a few of them barely protruding. The anterior spine of this series is located slightly in advance of the two series of pores near median line, the second opposite middle of series, the third opposite the posterior end. Tail with a strong series of lateral spines and a few small scattered prickles. The orbital spines form a series of 12 or 13 along the superior border of the orbit and spiracle. Two or three of these are over the posterior part of the spiracle, in a straight line, and are separated by a wider interspace from the supraorbital series proper. It is not possible to identify any of these spines as

the three primary spines of related species. A line of small spines follows each rostral cartilage, a patch consisting of three or four series near lateral margin of disk opposite the eye, and the usual band of depressed spines inside the angle of the disk, somewhat irregularly arranged, but not more than two or three series wide. The sides of the occiput, the interorbital space and the snout with patches of very minute prickles, barely visible to the naked eye. Similar minute prickles form a band around inferior margin of snout. The snout is much narrower and sharper than in *R. montereyensis*, the tip protruding, the anterolateral margins distinctly concave, the anterior margin, as a whole, strongly undulated. The spiracle is very large, but little smaller than the eye. The mouth is strongly curved, the symphyseal area produced and fitting into a strong notch of the upper jaw. The teeth have strong central cusps much longer than the diameter of the base, and are arranged in definite transverse rows with wide interspaces. One can also detect series which run lengthwise of the jaw, nearly parallel with its margin. The tail is very long and slender and the dorsal fins are widely separated; the interspace slightly exceeds the length of the base of either fin, and bears on its median line seven or eight small spines. In addition to the color marks already given for *R. equatorialis*, should be mentioned the conspicuous pair of lengthwise black streaks along interorbital area, the irregular dark line below the eye and a dark spot below the spiracle. *R. equatorialis* is not very closely related to any other American species.

CHLOPSIS GILBERTI Garman.

This species has been known hitherto only from the type taken by the *Albatross* in the vicinity of Panama. Four specimens are here recorded from station 4325, near San Diego, depth 191 to 292 fathoms. They answer Garman's description in all details, save the size of the eye and the width of the interval between the gill slits. The diameter of the eye is a little less than one-third the length of the snout, and is one-tenth or one-eleventh the length of the head. The interspace between gills equals the length of the gill-slit instead of one-half that length. But both of these characters are subject to considerable variation, and both are affected by the state of preservation of the material. In each specimen, the dorsal begins almost immediately above the gill-slits, and the belly is without dark streak.

VENEFICA TENTACULATA Garman.

A single specimen 247 mm. long from tip of tentacle to vent, from station 4389, off San Diego, depth 639 to 671 fathoms. Agreeing with Garman's figure and description in all respects, except the length of the rostral tentacle, which is, in this specimen, one-half the length of the rest of the snout. The origin of the anal is below the ninety-eighth ray of the dorsal. The gape extends beyond the eye for less

than half the ocular diameter. Posterior nostril in front of upper part of eye, its distance from eye less than its length, provided anteriorly with a wide valvular fold. There are 12 pores in a series above the maxillary, the posterior under front of eye; a series of 4 around posterior border of eye; 12 along the course of the mandible, this series continued backwards in a row of 7 following the curve of the preopercle, and a minute pair on each side of median line above; upper line of snout with 7 pairs, the posterior pair just within and behind the nostrils; an eighth pair lies over the posterior border of eye, above the preopercular series. Lateral line with 53 large pores from vent to head, thence continued forward above branchial region in a series of 9 pores, the posterior of which is less than half the size of the others.

Measurements, in hundredths, of length from tip of snout (exclusive of tentacle) to vent (233 mm.). (Lengths are given exclusive of tentacle, unless otherwise stated.)

Length of head	27
Length of tentacle	6
Length of snout (without tentacle).....	12.5
Distance from tip of snout to angle of mouth.....	15
Diameter of eye.....	2
Postocular length of head.....	12.8
Depth at vent.....	5.8
Greatest depth of tail.....	6.3
Depth at gill opening.....	3.6
Internarial width.....	.9

The terminal portion of the tail is mutilated.

The species is apparently close to *V. procera* from the Atlantic, but the position of the posterior nostrils in the latter has not been described. The gape in *V. procera* is longer, and the dorsal rays less numerous, the first anal ray being under the seventy-third of the dorsal.

ALEPOCEPHALUS TENEBROSUS Gilbert.

Several specimens from the following stations:

		<i>Fathoms.</i>
4307..	Near San Diego.....	169-496
4317..	.....do.....	161-510
4351..	.....do.....	423-510
4429..	.....do.....	506-680
4515..	.....do.....	198-495

The description by Jordan and Evermann¹ is inadequate and contains erroneous statements, which were not found in the original description.² Thus the maxillary is contained $2\frac{4}{5}$ or 3 times in the length of the head, not $2\frac{1}{5}$ times.

¹ Fishes of North America, vol. 1, p. 453.

² Proc. U. S. Nat. Mus., vol. 14, 1891, p. 545.

XENOGNATHUS, new genus (*Alepocephalidae*).

Closely related to *Alepocephalus*, differing principally in the structure of the mouth, the premaxillary greatly expanded, forming a plate extending nearly horizontally backward, within which the deep mandible is completely received. The anal fin is much longer than the dorsal. The body is compressed, elongate, covered with cycloid scales, and with well-developed lateral line. Teeth are present in the premaxillaries, the mandible, and the front of the palatines. Opercular flap voluminous; branchiostigals 6; gill membranes separate.

Type of the genus.—*Xenognathus profundorum*, new species.

XENOGNATHUS PROFUNDORUM, new species.

Plate 14, fig. 2.

Type-specimen.—Cat. No. 75826, U.S.N.M., 525 mm. long, from station 4390, off Catalina Island, lat. $33^{\circ} 02' 15''$ N.; long. $120^{\circ} 42'$ W.; depth 1,350 to 2,182 fathoms.

Dorsal, 19; anal, 28; pectoral, 12; ventrals, 6. Pores in lateral line, 62; scales in an oblique line upwards and backwards from lateral line to middle of back, 15.

Head deeper than wide, its length one-third the total length without caudal; greatest width of head 0.43 of its length; depth at occiput 0.54; depth opposite end of opercular flap 0.61; snout depressed at tip, bounded anteriorly by a strong sharp osseous crest on the basal portion of the premaxillaries; length of snout from eye, 0.29 of head; width of snout opposite the outer ends of the terminal crest, 0.26; frontal width opposite middle of eye, 0.27; longitudinal diameter of eye, 0.22; maxillary reaching vertical from middle of eye, its length measured from tip of snout, 0.45; length of premaxillary band of teeth, 0.27, the bone extending but little beyond the last teeth; vertical depth of mandible at symphysis, 0.6, the mandible shutting completely within the premaxillaries in closed mouth, the premaxillary teeth directed horizontally inward across the inferior aspect of the mandible.

Premaxillary teeth slender, cardiform, anteriorly in a very narrow band, laterally in a single series. Mandibular teeth similar, in a narrow band or irregular series anteriorly. A single series of teeth on the front of the palatines, which overlap the vomer anteriorly, and are separated by a short distance on the median line. Vomer and maxillary toothless. Gill-rakers 3 + 13 on outer arch, without teeth, the longest 0.055 length of head.

Origin of anal midway between middle of caudal base and margin of opercular flap; base of anal 0.66 length of head. Origin of dorsal under sixth anal ray, its last ray under the fourth before the last of

the anal, its base 0.40 length of head. Caudal forked. Pectoral inserted below the middle of the depth, its upper ray below level of pupil; length of pectoral, 0.45 of head, scarcely reaching vertical from base of ventrals. Base of ventrals slightly nearer base of caudal than tip of snout.

Body completely invested with cycloid scales, which do not extend on the bases of the fins.

Dark brown throughout on body and fins, the head nearly black.

Only the type known.

LEUROGLOSSUS STILBIUS Gilbert.

List of stations.

		Fathoms.
4427..	Off Santa Cruz Island.....	447-510
4461..	Monterey Bay.....	285-357
4468..	.....do.....	32-309
4512..	.....do.....	334-530
4515..	.....do.....	198-495
4533..	.....do.....	144-293

A single scale in one specimen still attached to the middle of the dorsal region is nearly twice as deep as long, cycloid in structure, and with entire margin. There were apparently 38 scales in a series along middle of sides. The ventrals are inserted somewhat in advance of the middle of the dorsal, but little behind a vertical from origin of dorsal.

BATHYLAGUS PACIFICUS Gilbert.

Bathylagus borealis GILBERT, Rept. U. S. Fish Comm. for 1893, 1896, p. 402.

Four specimens of this rare form were obtained in better condition than any previously secured. From these it appears that the characters alleged to distinguish it from *B. borealis* from Bering Sea are unreliable. The depth of body in these specimens is contained from $5\frac{1}{3}$ to $5\frac{1}{2}$ times in total length without caudal. The distance from front of anal to base of caudal exceeds the length of the head and is contained $3\frac{1}{2}$ to $3\frac{4}{5}$ times in total length without caudal. The front of dorsal is midway between the insertion of adipose fin and the tip of the snout, or slightly nearer the latter. Dorsal, 10 or 11; lateral line, 40. The last two rays of the dorsal and anal are closely apposed and might be considered a single ray split to base.

MYCTOPHUM AFFINE (Lütken).

Myctophum nitidulum GARMAN, Mem. Mus. Comp. Zoöl., vol. 24, 1899, p. 266, pl. 56, fig. 3.

Rhinoscopelus oceanicus JORDAN and EVERMANN, Bull. U. S. Fish Comm., vol. 22, 1902, p. 168.

Myctophum margaritatum GILBERT, Bull. U. S. Fish Comm., vol. 23, pt. 2, 1905, p. 596, pl. 68, fig. 2.

Here recorded for the first time from the California coast, a single young specimen having been taken at the surface at station 4392,

off Santa Catalina Island. The anal photophores are 8+5 on one side, 8+6 on the other. The species is generally distributed throughout the warmer parts of the Pacific Ocean, the nearest record to the California coast having been lat. 27° 50' N.; long., 145° 45' 30'' W. (type of *M. nitidulum* Garman), and lat. 28° 13' 42'' N.; long., 145° 44' W. (*M. margaritatum* Gilbert).

The Pacific form has been compared with one of Lütken's types from lat. 8° 44' N., long. 21° W., and with numerous specimens from the Atlantic coast of the United States. The alleged differences seem to be due wholly to inaccuracies in current figures and descriptions of the Atlantic form.

The type of *R. oceanicus* is described as having 7 antero-anals. Doctor Evermann informs me that the cotype taken at the same station has the anal photophores 10+5.

TARLETONBEANIA CRENULARIS (Jordan and Gilbert).

Two young specimens 28 and 30 mm. long were taken at the surface at station 4386, midway between San Diego and San Clemente Island.

Direct comparison has been made between the types of *T. crenularis* and *T. tenua*, with the result of establishing the identity of the two forms. The alleged difference in form is due to the distortion of the type-specimens, neither of which is in perfect condition. The alleged discrepancy in number of anal photophores is due to inaccuracy in the description of *T. crenularis*, the type having 10+4 anals and 1 precaudal, while the type of *T. tenua* has 11+4 anals and 1 precaudal. The statement of the describers of *T. crenularis* that there are 21 pairs of phosphorescent spots between front of anal and base of caudal can be accounted for only on the assumption that the authors supplied spots to fill the gaps between the two anal series and between the posteroanals and the precaudal.

The species has been correctly assigned to the vicinity of *Myctophum*. It differs from all species of that genus in the absence of pores on all but the first 2 or 3 of the lateral line scales, in the constant presence of a single precaudal, 6 thoracics and 6 ventrals, instead of 2 precaudals, 5 thoracics and 4 ventrals. In addition, luminous areas on caudal peduncle are wholly wanting, the dorsal is posterior in position and the scales are crenulate.

As current accounts of the species are more or less conflicting and misleading, the following description is offered:

Dorsal, 13; anal, 18; pectoral, 13; ventral, 8 (an outer rudimentary concealed ray can be made out in the young); scales in midlateral series, 48 or 49.

With much the appearance of *Rhinoscopelus*, the caudal peduncle long and slender, the snout slightly protruding beyond the mouth in the young, apparently not protruding in adults. Mouth large,

maxillary slender, not widened at tip, extending far behind eye nearly to preopercle. Eye very large in adults, smaller in young as usual in this group. Preopercle little oblique. Gill-rakers strong, the longest 0.6 the diameter of eye, 6+11 in number.

Dorsal posterior in position, midway between tip of snout and base of caudal or slightly nearer the caudal, the middle of the dorsal vertically above the third or fourth anal ray. Adipose dorsal over the last anal rays. Pectoral inserted low, its upper rays on level with lower margin of orbit, extending beyond base of ventrals, the latter not reaching the vent. The caudal is gently forked, not rounded as represented by Goode and Bean.¹

Scales in adults crenulate, those along midlateral series weakly, those along back most strongly incised. In the young the scales appear to have entire edges. Scales of midlateral series much deeper than the others, the first three or four of them perforated and containing tubes of the lateral line, all others of the series without trace of tubes.

Photophores.—A minute preocular on lower anterior orbital margin below level of nostril, and a minute supraocular on upper orbital rim vertically above posterior margin of pupil; both of these obscure in adults. Mandibular photophores 3, opercular 2, in their usual relations, the lower opercular spot immediately behind posterior end of maxillary, very small, becoming obscure in adults. Pectorals 3, the suprapectoral low, wholly covered by the overlapping subopercle, in advance of the upper pectoral rays and a little below their level; upper infrapectoral immediately in advance of the lower pectoral rays, lower infrapectoral in a line joining the upper infrapectoral and the first thoracic, a little behind the second thoracic. Thoracics 6, the first pair almost in contact, placed vertically below the lower opercular spot, succeeding pairs progressively more widely separating, the two series regularly diverging backwards, the last pair in advance of outer ventral rays; the second interval (between second and third pairs) the longest, first interval but little shorter, the fourth the shortest, the third and fifth equal. Supraventral low, vertically above first ventral pair, on a level with middle of pectoral fin. Ventrals 6, the first pair nearly in contact on median line, nearer together than the bases of ventral fins; succeeding pairs much farther from midventral line, each series forming a gentle curve with the convexity outwards; interval between first and second pairs longest, the others about equal. Supraanal 3, somewhat angulated, the angle varying in different individuals, but always evident. Uppermost supraanal but little below the lateral line and slightly in advance of the vertical from the first anal pair, the second vertically above first anal ray, the lowest below and in advance of

¹ *Oceanic Ichthyology*, pl. 28, fig. 105.

the second, slightly behind vertical from sixth ventral pair, separated from the middle spot by an interval equal to those separating those of the ventral series. In 7 specimens, including the types of *crenularis* and *tenuis*, the anteroanals vary from 10 to 11, the posteroanals from 3 to 5. The posterolateral is above or a little behind the last anteroanal, and but little below the lateral line. The last anal ray is about opposite the first posteroanal. The single pair of precaudals almost in contact below, placed immediately in advance of the rudimentary rays of lower caudal lobe.

Back brownish, rest of head and body silvery, the posterior margin of each scale marked in adults by a curved series of short radiating hair lines of black pigment.

LAMPANYCTUS LEUCOPSARUM (Eigenmann).

Apparently the most abundant deep pelagic species along the California coast. Many specimens were secured, all of them typical of *leucopsarum*, with no indication of an approach to the closely allied *L. nannochir*. The latter species seems to be more northerly in its distribution, the statement made by the present writer¹ to the effect that *L. nannochir* had been taken in the Santa Barbara Channel being an error. Both *leucopsarum* and *nannochir* are found in Bering Sea, where *nannochir* is the most abundant, and both extend southward as far as the northern part of California. But in the southern part of California, south of San Francisco, only *leucopsarum* has as yet been taken, and in this region it is remarkably abundant.

The general coloration is lighter than in *nannochir*, the middle of sides always grayish silvery. The fins are translucent, or faintly pigmented, the caudal alone having a broad blackish bar at base, from which conspicuous dusky lobes extend into the basal portion of the corresponding lobes of the caudal fin. The ventrals are translucent, while in *nannochir* they are blackish, with a median light area.

Photophores always golden in color. In all specimens from the present collection there are 4 precaudals, and in all but 3 specimens the anals are 6+7 in number (the anterior group varying to 7, the posterior to 6 or 8 in the 3 specimens mentioned). Ventral photophores 4, supraanals 3 (4 in one specimen). The species is thus more constant in the southern part of its range than it is farther north, where the anteroanals are nearly evenly divided between 6 and 7, and the posteroanals between 7 and 8, where the ventrals occasionally vary to 5 and the supraanals to 2 or 4. The tracts of luminous scales on the upper and under sides of caudal peduncle are constantly longer than in *nannochir* and the "scales" more

¹ Report U. S. Commissioner of Fisheries, 1896, p. 399.

numerous, there being 6 or 7 in the upper tract (5 in 2 specimens) and 8 or 9 in the lower.

The deeper caudal peduncle, larger eye, and firmer texture also characterize this species; but, above all, the yellow photophores and the number (4) of precaudal photophores, it being now shown through recently acquired material that in *nannochir* the photophores are claret color in life, and the number of the precaudals is normally 3.

List of stations.

		<i>Fathoms.</i>
4307	Off San Diego.....	169-496
4327	.....do.....	263-330
4341	.....do.....	188-323
4368	.....do.....	240
4412	Off Catalina Island.....	265-274
4423	Off San Nicolas Island.....	216-339
4424	.....do.....	581-594
4484	Off San Miguel Island.....	270-281
4435	.....do.....	274-287
4461	Monterey Bay.....	285-357
4468	.....do.....	32-309
4512	.....do.....	309-530
4515	.....do.....	198-495
4527	.....do.....	183-337
4529	.....do.....	780-799
4533	.....do.....	144-293
4536	.....do.....	1,006-1,041
4538	.....do.....	795-871
4539	.....do.....	465-609
4540	.....do.....	389-551
4541	.....do.....	381-633
4542	.....do.....	331-677
4544	.....do.....	724-1,000
4545	.....do.....	700-900
4547	.....do.....	1,083

LAMPANYCTUS REGALIS (Gilbert).

Myctophum regale GILBERT, Proc. U. S. Nat. Mus., vol. 14, 1891, p. 7.

As current descriptions of this species are incomplete and faulty, especially as regards the distribution of the photophores, additional details are here given, based on newly obtained material and verified on the type.

Measurements in hundredths of length without caudal (153 mm.; specimen from station 4407):

Length of head, 28; diameter of eye, 4.8; length of snout, 5.8; interorbital width over middle of eye, 9; length of longest gill-raker, 4; orbits, 8; length of maxillary, 21.3; distance from orbit to preopercular angle, 16.7; greatest depth of body, 20; least depth of caudal peduncle, 11; distance from snout to dorsal, 47; to adipose fin, 76; to ventrals, 44.5¹; to anal, 59; base of adipose fin, 3.2; height at posterior margin of adipose, 6; length of pectoral, 11.5; length of ventral, 14.5; length of dorsal base, 18; of anal base, 21. Dorsal, 15, or the first a minute rudiment, 16; anal, 18 or 19; ventral, 9, the outer ray short and simple; pectoral, 12. Scales in lateral line 37 or 38, 3½ rows between lateral line and base of dorsal.

¹ Frequently less, 41 or 42.

Gill-rakers slender, 4+9, with one rudiment above, three below.

Eye small, shorter than snout; maxillary long, but not reaching the anterior margin of the very oblique preopercle; maxillary little widened at tip, scarcely wider than the dentigerous premaxillaries; vomerine teeth in two widely separated patches; palatine bands broad, elliptical, nearly half length of premaxillaries.

Body elongate, with deep caudal peduncle. Ventrals inserted in advance of origin of dorsal, the latter nearer tip of snout than caudal; pectoral well developed, but slender and pointed, none of the rays filamentous, the third, fourth, and fifth the longest, reaching to or nearly to base of ventrals. Ventrals reaching origin of anal. First anal ray under the ninth or tenth of the dorsal. Adipose fin unusually large, over last anal rays.

Scales caducous, those in lateral line enlarged, much deeper than the others.

General color blackish, including the rays and membranes of all the fins; ventrals with a distinct whitish blotch on inner rays.

Photophores.—No distinct antorbitals can be detected in any of our specimens, but smaller individuals would probably exhibit them. In none of our specimens is the integument of the head perfectly preserved; enough remains, however, to show that the cheeks, sub-orbital region, snout, and vertex are covered with extremely numerous minute luminous organs, which seem to be present also on the opercles and are perhaps generally distributed on other parts of the head. On the anterior part of the cheeks, they are present in definite oblique somewhat wavy lines. A somewhat larger luminous body is present on lower posterior portion of cheeks. The usual photophores below the preopercle are present, but like those on the branchiostegal membranes are poorly developed and obscured by the black pigmentation of the parts. Photophores on body very small, scarcely more than half the size of those in *L. ritteri*, resembling those in *L. niger* and *L. macropterus*.

Suprapectoral immediately below lateral line; upper infrapectoral immediately in front of upper pectoral ray and slightly below it, the lower infrapectoral below and behind the upper, the three pectoral spots nearly in line. Thoracics 5, the fourth elevated, on level of upper pectoral rays, a little behind vertical from third pair of thoracics; spots of first three pairs about equally distant from median line, those of fifth pair very widely separated, in front of outer ventral rays; second interspace shortest, the first longest. Supraventrals vertically above ventral fin, on second scale below lateral line, high above the level of the anterior supraanals, its distance from lateral line half or slightly more than half its distance from ventral fins. Ventrals 4, first pair behind inner ventral rays and nearest the median line, the second pair most divergent, the second

to fourth pairs forming gently converging lines, the fourth pair at the sides of vent and a little anterior to it; first interspace shortest, the third longest. Supraanals angulated, the upper in contact with the lateral line, vertically above base of first anal ray, the middle pair above the vent or slightly behind it, about midway between lateral line and lower profile, the anterior pair horizontally in front of middle pair, or a trifle lower, just in advance of vertical from third ventral pair. Anteroanals 8, the last pair elevated, in line joining the seventh and the posterolateral, halfway between the two or a trifle nearer the seventh pair; all but the eighth pair, form a high arch with its concavity toward the anal base, the first pair much nearer anal base than the second, the third still farther diverging, the remaining pairs again gradually approximating anal base, the seventh pair over the fifth before last anal ray. Posterolateral in contact with lateral line. Posteroanals 7 or 8. Precaudals 4, the lower 3 forming a direct continuation of the anal series, there being sometimes a short interruption but frequently none; the intervals between the precaudals usually shorter than those of the anal series, the three forming an arch at base of the lower caudal lobe, the third noticeably elevated; last precaudal on the lateral line. A patch of 3 overlapping luminous scales on back of caudal peduncle and 4 to 7 below.

Several specimens, ranging in length from 63 to 190 mm., were obtained with the trawl at the following stations:

		<i>Fathoms.</i>
4317	Off San Diego.....	161-510
4406	Off Catalina Island.....	650
4407	.....do.....	334-600
4423	Off Santa Barbara Island.....	339-216
4428	.....do.....	764-891
4512	Off Monterey.....	469-334
4513	.....do.....	456-389
4516	.....do.....	718-756
4540	.....do.....	551-350

LAMPANYCTUS RITTERI, new species.

Plate 15, fig. 3.

Type-specimen.—Cat. No. 75807, U.S.N.M., 120 mm. long to base of caudal, about 142 mm. total length; from station 4513, Monterey Bay, 389 to 456 fathoms.

Measurements in hundredths of length to base of caudal: Length of head, 26.6; length of snout, 4.8; diameter of eye, 5.3; interorbital width, 7; length of maxillary, 19; distance from posterior angle of cheeks to orbit, 12.5; length of longest gill-raker, 4; greatest depth of body, 20; depth at adipose fin, 14; least depth of caudal peduncle, 12; distance from snout to front of dorsal, 46.5; length of dorsal, 15.5; longest dorsal ray, about 20; distance from snout to ventrals, 39; to anal, 55; to adipose fin, 75; length of pectorals, 13; of ventrals, 14; of anal base, 12.

Dorsal 14, the last ray cleft to base; anal 18, the last ray divided; pectoral 12; ventral 9, the outer ray a short simple rudiment. Lower caudal lobe preceded by 7 inarticulate, spine-like rays, upper lobe with 6. Thirty-eight scales in lateral line, the 18th covering the upper supraanal photophore, the 26th scale covering the posterolateral.

Elongate, with deep compressed caudal peduncle, the latter of nearly equal depth throughout; mouth oblique, the maxillary scarcely widened at tip, not wider than the exposed portion of the premaxillary, which reaches the angle of the mouth and is everywhere denticulous; snout short, acute, the premaxillaries anteriorly on the level of middle of orbit, the mandible slightly protruding; both jaws with broad bands of short teeth of uniform length, mostly disposed on the outer exposed surfaces of the bones; vomer with two short patches of teeth, separated by a wide interval; palatine patches wide, extending along the anterior two-thirds of the premaxillaries. Gill-rakers slender, 1 rudiment and 4 developed above the angle of the first arch, 1 or 2 rudiments and 10 or 11 developed below the angle. Eye small, anteriorly placed, half the maxillary behind its posterior border. Upper portion of opercle marked with concentric lines, and with weaker radiating lines which diverge from the joint; subopercle with lines radiating backward and downward.

Scales mostly lost; the few remaining extremely thin and flexible with entire edges, those of the lateral line much higher than the others, but largely concealed by overlapping scales above and below; $3\frac{1}{2}$ series between lateral line and base of dorsal.

Third dorsal ray midway between snout and rudimentary caudal rays; the middle of the length, exclusive of caudal, is under the fifth dorsal ray. Ventrals inserted well in advance of dorsal, about midway between front of eye and last anal ray, the longest ventral ray extending slightly beyond the vent. Pectorals of moderate width, their tips reaching base of ventrals. First anal ray slightly behind vertical from middle of dorsal base. Adipose fin small, inserted over the posterolateral, a little in advance of last anal ray.

Photophores of normal size, much larger than in *regale*. When uninjured, the majority of them are crossed by a curved pigment band, similar to that in *Diaphus*, but lacking the definiteness there found. Antorbital small, below axis of eye, detected with difficulty in adult specimens. A single photophore near posterior angle of cheeks, above terminal portion of maxillary. The usual spots under preopercular margin and on gill membranes. A small humeral spot present at upper end of opercular cleft. Suprapectoral on the first scale below lateral line, its distance from lateral line one-fourth its distance from pectoral fin; upper infrapectoral above middle of pectoral base but below its uppermost rays; lower infrapectoral vertically below the upper, slightly in advance of a line joining the other

two. Thoracics 5, the fourth elevated, on a level with upper pectoral rays or slightly above them, a trifle behind vertical from third thoracics; first, second, third, and fifth pairs of thoracics forming gently diverging lines, the fifth less widely separated than in *L. regale*, not opposite the outer ventral rays; second and fourth thoracic interspaces equal, the first one-third longer. Supraventral vertically above ventral base, midway between ventral base and lateral line, very little above the line joining the two lower supraanals. Ventrals 4, the first pair nearest the median line, at base of inner ventral rays, those of second pair most widely separated, forming with the third and fourth pairs lines gently converging to the sides of the vent. Supraanals angulated, the first and second in a line parallel with lateral line, a little nearer the ventral outline than the lateral line, the first over or slightly in advance of the third ventral spot, the second vertically above the first anal ray; third supraanal in contact with the lateral line, above the interspace between first and second anals. Anteroanals 8, the first 7 forming a weakly curved line with the concavity downward, the eighth abruptly elevated, in a line joining the seventh and the posterolateral, but constantly a little nearer the seventh. Posterolateral in contact with lateral line, a little in advance of last anal ray. Posteroanals forming with the lower precaudals an unbroken series of 11 photophores; the last precaudal abruptly elevated, at the end of the lateral line; the next to the last precaudal a little elevated, vertically below the last. While there is no interruption to mark off the lower precaudals from the posteroanals, the last three of this series lie above the caudal rays and are a little more widely spaced. The total number of precaudals may therefore be taken as 4, a number agreeing with that found in other closely related species in which the series is broken. In one specimen of *L. ritteri*, evidently abnormal in this respect, 4 smaller photophores are crowded above base of lower caudal lobe. A short luminous patch on back of caudal peduncle, occupying in the type one-third the distance from caudal to adipose fin, consisting of 4 luminous scales; a similar patch below occupies nearly the entire length of caudal peduncle, containing in the type 8 luminous scales.

General color black, including the mouth and lining of gill cavity. Fins dark at base, none of them black, all marked by fine wavy lines formed by black pigment along lines of articulation of the rays.

This species is very closely allied to *L. regale*, with which it is found associated. From *L. regale* it differs:

(1) In the much larger photophores, these being very small in *regale*.

(2) In the absence of the extremely numerous minute photophores on cheeks.

- (3) The lower supraventral, which in *regale* is near lateral line and much above the level of the first supraanal.
- (4) The posterior position of the upper and middle supraanals, the upper in *regale* being in advance of first anal ray.
- (5) The lower last anteroanal, this in *regale* half way between the preceding anal and the posterolateral.
- (6) The lighter fins, the fin membranes being all black in *regale*.
- (7) The much smaller adipose fin.
- (8) The more anterior insertion of ventrals.
- (9) The shorter head.

Paratypes were secured from the following stations:

4400	Off San Clemente Island.....	<i>Fathoms.</i> 500-507
4403	.....do.....	599-505
4539	Monterey Bay.....	551-350

A single very young specimen was also secured by Doctor Ritter, off La Jolla, near San Diego, at a depth of about 400 fathoms.

CHAULIODUS MACOUNI Bean.

List of stations.

4393	Off Santa Catalina Island.....	<i>Fathoms.</i> 2, 113-2, 259
4405	Off San Clemente Island.....	645-704
4515	Monterey Bay.....	718-756
4544	.....do.....	724-1,000

The above depths have no significance, as the species may well have been captured as the open-mouthed trawl was being hauled to the surface. It has frequently been taken in nets sent down to only 300 fathoms, and is undoubtedly to be reckoned among the deep pelagic forms. In one specimen the stomach contents consisted of *Sagitta* and other pelagic organisms.

C. macouni is evidently distinct from *C. sloani*, *C. barbatus*, and *C. pammelas*, having a larger number of ventral photophores than either of these species. According to Brauer¹ *C. sloani* has 23 to 26 ventral organs, usually 23 or 24, while *C. barbatus* has 22 or 23 and *C. pammelas* 20 or 21. In *C. macouni* there are 26 to 29 photophores between the front base of ventrals and the front of anal fin, usually 27 or 28. This number agrees with that given by Garman for *C. dentatus* (29). But the latter species has a wider pectoral (14 rays), a longer anal (13), and a larger number of photophores from front of anal to caudal (14) than we have found in any specimen of *C. macouni*. On the other hand, the California species seems to agree in every respect, both as regards proportions of parts and the

¹ Die Tiefsee Fische, 1906, p. 41.

number and distribution of photophores with *C. emmelas* Jordan and Starks, from Japan.¹

In *C. macouni* the branchiostegal rays vary in number from 18 to 20; the anal rays are 11 or 12 and the pectoral rays 11 or 12 in number, 11 predominating in both fins. The lower series of luminous organs are 8 + 20 to 22 + 26 to 29 + 11; the upper series, 17 to 20 + 25 to 27. Length of head, fifteen one-hundredths of total length without the caudal fin; depth, 13; distance from front of base of pectorals to base of ventrals, 26; from ventrals to front of anal, 41; from tip of snout to front of dorsal, 23½.

In *C. emmelas* the luminous organs are present as follows: Lower series, 8 + 20 to 22 + 26 to 29 + 11; upper series, 17 or 18 + 26 or 27.

ZASTOMIAS, new genus (*Stomiidae*).

Body naked; mouth very large, much as in the Malacosteids, the maxillary reaching almost to mandibular joint, the latter extending beyond the opercular border and well beyond the base of the pectorals. Long slender nondepressible fangs in the front of the mandible, overlapping the opposite pair, or fitting into grooves within the upper jaw. Maxillary toothed throughout, the posterior teeth small, retrorse. Tongue and palatines with slender teeth, vomer naked. Barbel very long, with enlarged tip. Pectorals inserted very low, close together near the median line, the anterior ray specialized, greatly thickened and probably detached, though the total absence of the pectoral membrane makes it impossible to determine this point with certainty. All the pectoral rays are filamentous. Ventrals well behind the middle of the length, near together on the ventral surface, dorsal and anal far back near the tail, nearly equal and opposite. Caudal forked. Two large luminous organs on the head, two series of small organs along lower side of trunk and tail, the entire surface of head and body thickly beset with minute luminous bodies, much as in *Opostomias*. Distinguished from all other genera by the very large mouth, the unequal nondepressible fangs, the palatine teeth, and the very numerous minute, luminous organs.

Type of the genus.—*Zastomias scintillans*, new species.

ZASTOMIAS SCINTILLANS, new species.

Plate 15, fig. 4.

Type-specimen.—Cat. No. 75808, U.S.N.M., 72 mm. long, from station 4540, Monterey Bay, depth 389 to 551 fathoms.

Dorsal, 21; anal, 27; ventrals 4 on one side, 6 on the other, without apparent injury; pectorals, 1 + 3.

Measurements in hundredths of length without caudal: Length of head to opercular margin, 27; length of snout, 7.8; frontal width

¹ Bull. U. S. Fish Comm., vol. 22, 1902, p. 579.

over middle of orbits, 7; diameter of eye, 5; distance from tip of snout to end of maxillary, 26; to mandibular angle, 27; length of barbel, 61; greatest depth at nape, 17; least depth, 3; distance from tip of snout to base of pectorals, 24; to base of ventrals, 58; to origin of dorsal, 78; to origin of anal, 79; length of filamentous pectoral rays, 18; longest ventral ray, 19; length of base of dorsal, 14; of anal, 17.

Body deepest at the nape; occiput and interorbital space strongly arched transversely, the eye about equidistant from profile and from mouth; anterior profile strongly decurved from the occiput to the very narrow rounded snout. Nostrils without tubes, in a horizontal line in front of eye.

Mandible with a strong anterior pair of fangs which in the closed mouth lie in shallow grooves in the anterior surface of the snout and upper jaw. A second somewhat shorter pair also lie outside the premaxillaries, when the mouth is closed, in deeper grooves or sockets beneath the posterior nostrils. Behind this five pairs of shorter canines of about equal length, evenly spaced along the jaw. Teeth in premaxillaries agreeing in number and arrangement with those in the mandible, but all shorter than the shortest of the mandibular series; the posterior premaxillary fangs are retrorse. Maxillary firmly joined to premaxillary, its entire length beset with minute retrorse teeth. Palatine teeth small, in a single series. Eye small, its diameter less than length of snout, its anterior margin in advance of the middle third of the jaw. Barbel very long and slender, reaching well beyond base of ventrals, provided with a smooth club-shaped tip.

Dorsal and anal opposite and nearly equal. Caudal moderately forked. Ventrals inserted low, midway between base of caudal and middle of cheek, the elongate tips nearly reaching the vent.

Color black. Head, body, and fins thickly beset with minute luminous bodies, many of which are arranged in vertical intersegmental lines. Two lengthwise series of slightly enlarged spots on lower part of sides, the upper series usually widely spaced, but with occasional groups of four or five closely crowded spots occupying definite positions. The integument has suffered to such an extent that a detailed description of the two series is impossible. A narrow curved luminous organ on the lower margin of the anterior half of the eye and a larger oval spot behind it on the cheek.

Only the type known.

IDIACANTHUS ANTROSTOMUS Gilbert.

One specimen from station 4415, off Santa Barbara Island, depth 131 to 638 fathoms.

COLOLABIS BREVIROSTRIS (Peters).

Several young specimens, 15 to 55 mm. long, were taken in the surface tow at the following stations:

4308	Off San Diego.....	Surface.
4313	do.....	Do.
4385	do.....	Do.
4389	do.....	Do.
4390	Off Santa Catalina Island.....	Do.
4392	do.....	Do.

A specimen of this species about 10 inches long has recently been taken by us off the western coast of Vancouver's Island, thus well to the northward of its reported range.

MELAMPHAËS CRISTICEPS Gilbert.

=? *Melamphaës nigrofulvus* GARMAN, 1899, p. 64, pl. D, fig. 2.

Hitherto reported from off the coast of Washington, and from Monterey Bay, California. A specimen in the present collection is from station 4403, off San Clemente Island, southern California, 505 to 599 fathoms.

The length from tip of snout to base of caudal is 84 mm. The following measurements are given in hundredths of this length: Length of head, 41; diameter of eye, 6; length of snout, 11; length of maxillary, 18; longest gill-raker, 7; distance from tip of snout to posterior line of occiput, 26; to front of dorsal, 49; to front of anal, 64; to base of ventrals 42; to base of pectorals, 41; length of dorsal base, 26; of anal base, 11.7; length of pectorals, 32; of ventrals, 18; depth of body, 30; least depth of caudal peduncle, 11.5; length of caudal peduncle, from base of last anal ray to first caudal ray, 22.5; from last dorsal ray to first caudal ray, 26.

Dorsal, III, 13; anal, I, 9; pectoral, 15/15; ventrals, I, 7; lateral line 23 or 24, counting from posterior opercular margin; gill-rakers 9+20, long, broad at base, tapering to a slender tip, weak and flexible.

The median spine on snout is directed upwards and slightly backwards; the skull is of firm cartilaginous texture, especially in the occipital and preocular areas. The mouth is oblique, the maxillary extending beyond the orbit.

The ventrals are inserted below or very slightly behind the base of pectorals.

The first dorsal ray is barely in advance of the middle of the length (excluding caudal). The first anal ray falls below the sixth before the last of the dorsal; last dorsal ray midway between the first ray of dorsal and the first of caudal.

M. unicornis Gilbert from the Hawaiian region has the dorsal, anal, and ventral fins more posteriorly inserted, their distances from tip of

— snout being 55, 69, and 46 hundredths, respectively. The width of head and interorbital area are appreciably less, and the caudal peduncle is more slender. *M. nigrofulvus* Garman from the vicinity of Panama, is very similar, but has apparently a slightly shorter maxillary, which does not extend past the orbit, and also slightly smaller scales. But the two may be identical.

MELAMPHAËS BISPINOSUS, new species.

Plate 15, fig. 5.

Type-specimen.—Cat. No. 75809, U.S.N.M., 75 mm. long, from station 4382, off the Coronado Islands near San Diego, 642 to 666 fathoms.

Dorsal II, 11; anal I, 8; pectorals, 13 in each fin; ventrals I, 7 on each side. Scales fallen, the pouches indistinct, probably 23 to 25 in number. Gill-rakers 9 + 15 in number, the one in angle included with the upper set.

Length of head, 43 hundredths of total length without caudal; length of snout, 12.5; diameter of eye, 5; least interorbital width, 16.5; length of maxillary, 16; length of longest gill-raker, 6.5; depth at occiput, 28; greatest width of head, 20; greatest depth of body, 30; least depth of caudal peduncle, 12; length of caudal peduncle from last anal ray, 26; distance from tip of snout to base of pectoral, 41.5; to ventrals, 40; to front of dorsal, 47; to front of anal, 63; length of dorsal base, 23.5; of anal base, 10; length of pectoral fin, 29.

Snout rather long, gently declivous, $2\frac{1}{2}$ times the diameter of the eye; mandible scarcely protruding, without symphyseal knob; cleft of the mouth oblique, the maxillary slightly passing the middle of the eye, a trifle less than the interorbital width; posterior margin of preopercle nearly vertical, the anterior crest with two or three teeth at angle, the lower limb with well-marked diverging striæ, forming a continuous series with those on the interopercle; opercle with a strong ridge running upwards and backwards, and one downwards and backwards, continued across the subopercle; the upper portion contains a set of strong diverging striæ; subopercle produced upwards and backwards to form a long pointed projection distinct from the posterior margin of the opercle. Occipital region of the skull firm and cartilaginous in texture; no cartilaginous area about the orbit; crests thin and papery, high, but less so than in *P. beani*, from the Atlantic. The ridge formed on the median line by the lower mandibular crests is much lower, and the upper lateral mandibular expansions fail to meet those from the suborbitals, and thus do not conceal the maxillary; the area between the occipital crests is narrow, its width not greater than the diameter of the eye; a vertical plate in the mesethmoid replaces the spine seen in *P. unicornis* and *cristiceps*.

Origin of dorsal nearer tip of snout than base of caudal, the length of its base contained $1\frac{1}{4}$ times in its distance from first upper caudal ray; first anal ray under the fifth before the last dorsal ray, the last dorsal ray over the middle of anal base. Base of ventrals slightly in advance of base of pectorals; the pectoral fin extends beyond the base of the dorsal.

Apparently jet black in life, including the mouth and gill cavity.

M. bispinosus is apparently most nearly related to *M. beani*, with which it agrees in having but two spinous rays in the dorsal fin. It differs in the longer snout, longer slenderer head, shorter caudal peduncle and lower crests on head. A specimen of *M. beani* from the United States National Museum shows the following measurements: Length of head, 36 hundredths of total length to base of caudal; greatest width of head, 18; interorbital width, 15; length of snout, 8.5; length of longest gill-raker, 5; distance from tip of snout to occiput, 19; to front of dorsal, 49; to front of anal, 54; to base of ventrals, 33; to base of pectorals, 35; length of caudal peduncle from last anal ray, 35.

Paratypes were obtained from the following stations:

		Fathoms.
4335	Off San Diego.....	500-534
4336	.....do.....	518-565
4382	Off Coronado Islands.....	642-666
4402	Off San Clemente Island.....	542-599

MELAMPHAËS NYCTERINUS, new species.

Plate 16, fig. 6.

Type-specimen.—Cat. No. 75810, U.S.N.M., about 80 mm. in total length (caudal fin injured), from station 4393, off Santa Catalina Island, 2,113 to 2,259 fathoms.

Dorsal, II, 12; anal, I, 8; pectorals, 14 in each fin; ventral, I, 7. Scales in 27 oblique series downward and backward, 12 or 13 scales in an oblique series from front of dorsal to front of anal.

Length of head, 38 hundredths of total length without caudal; length of snout, 11; diameter of eye, 3; least interorbital width, 10; length of maxillary, 18; depth at occiput, 28; greatest width of head, 20; greatest depth of body, 29; least depth of caudal peduncle, 10; length of free portion of caudal peduncle, 26; distance from tip of snout to pectoral, 41; to base of ventral, 43; to front of dorsal, 50; to front of anal, 71; length of base of dorsal, 23; length of base of anal, 8; distance from base of ventral to origin of anal, 28; length of pectoral, 30.

Head moderately compressed, rather thick, the circumocular crests well developed, other crests low; occipital area prominent, firm, without lateral winglike expansions; supraorbital expansions high, rather firm, overarching and largely concealing the eye; anterior and

posterior margins of orbit with winglike crests, which meet in an acute angle below; eye not surrounded by the well-developed cartilaginous plate present in some species. Eye smaller than in any other known species, but apparently perfect. Its diameter is less than a third the length of the snout or the interorbital width. Mouth large, oblique, the maxillary extending well beyond the orbit; mandible slightly protruding, without symphyseal knob; inner mandibular edges produced, the two meeting to form a low crest. Teeth subequal, in narrow bands in the jaws, the palate toothless. Gill rakers long and slender, 5+14 on outer arch, the longest nine one-hundredths of the standard length; gill laminae very short, the outer row on the first arch shorter than the width of the arch. Pseudo-branchiae reduced to 2 or 3 filaments. Branchiostegals, 8.

Preopercular margins nearly vertical, little elevated, the anterior with two weak spinous points at angle. Opercle with a vertical and a horizontal ridge, the bone marked with delicate diverging striae, with uneven surfaces.

Scales largely fallen, the few remaining with fine concentric striae. On the integument of the caudal peduncle are to be seen definite traces of the lateral line.

The origin of the dorsal is slightly nearer snout than base of caudal, the anal beginning under the next to the last dorsal ray. Ventrals inserted slightly behind the base of the pectorals. Pectorals long, extending slightly beyond the vertical from the vent, the other fins mutilated so their length can not be given. Base of pectorals oblique, extending downward and backward.

In spirits, uniform blackish brown, darker on the head; caudal fin yellowish. Buccal cavity and lining membrane of cheeks a lustrous light blue, the gill membranes, opercles, and jaws lined with brownish black.

Only the type is known.

M. nycterinus is most nearly related to *M. maxillaris* Garman, taken off the coast of Ecuador. *M. nycterinus* has a much smaller eye, a shorter maxillary, lower cephalic crests, a longer dorsal fin more anteriorly inserted, and an anal with longer base and slightly more anterior position. *M. cristiceps* has a still longer anal more anteriorly placed, much higher crests, and much larger eye, and many more gill rakers.

SCHEDOPHILUS HEATHI Gilbert.

A young specimen 33 mm. long was found in the cavity of *Pyrosoma* captured at station 4446, in Monterey Bay. Another specimen has been more recently taken by Dr. Harold Heath near Catalina Island, from the cavity of a *Salpa*.

CYMATOGASTER AGGREGATUS Gibbons.

Station 4476, Monterey Bay, 25 to 39 fathoms.

ZALEMBIUS ROSACEUS (Jordan and Gilbert).

List of stations.

		<i>Fathoms.</i>
4476	Monterey Bay	25-29
4492	.....do.....	26-27

HYPOCRITICHTHYS ANALIS (A. Agassiz).

List of stations.

		<i>Fathoms.</i>
4476	Monterey Bay	25-39
4475	.....do.....	58-85

SEBASTOLOBUS ALASCANUS Bean.

The following are distinctive characters of this species compared with *S. altivelis*:

Spinous dorsal normally XVI (rarely XV or XVII), the fin low, the outline regularly rounded, the spines increasing in length to the fourth or fifth, thence decreasing to the fourteenth, or occasionally the thirteenth, the last 2 (rarely the last 3) again lengthened. Notch between dorsals averaging deeper than in *S. altivelis*. Gill-rakers short, about half length of pupil, 6 in number on upper limb of outer arch, 9 developed and 4 rudimentary on horizontal limb. Cephalic spines all stronger; 2 well developed paroccipitals, the anterior immediately behind the upper posterior orbital rim, rarely broken up into 2 or 3 small points. Two distinct black blotches on spinous dorsal, the 2 rarely confluent, usually separated by half the length of the fin. Pectorals dusky, becoming lighter at base in the young, the basal light bar widening with age until the dark bar is confined to distal half of fin, the posterior margin usually whitish. The dark pectoral bar is crossed by narrow light vertical lines or by vertical series of light spots. Dark coloration of pectorals may wholly disappear in adults. The lining of buccal and gill-cavities is with little or no black pigment at any age. In life, this species is of a lighter more orange-red, the inside of mouth is white, only slightly tinged posteriorly, and the opercle shows a bare trace of dusky. The nasal cirrus is developed as a simple narrow tentacle.

List of stations.

		<i>Fathoms.</i>
4306	Off San Diego.....	207-497
4307	.....do.....	169-490
4322	.....do.....	110-199
4366	.....do.....	158-181
4410	Off Santa Catalina Island.....	178-195
4412	.....do.....	265-274
4421	Off San Nicolas Island.....	229-298
4462	Monterey Bay.....	161-313
4475	.....do.....	58-142
4509	.....do.....	152-286
4510	.....do.....	91-184
4522	.....do.....	130-149

SEBASTOLOBUS ALTIVELIS Gilbert.

Young individuals, 50 to 100 mm. long, can be distinguished at sight by the coloration. The opercles, gill-membranes, and the abdomen are blackish, the spinous dorsal and the ventrals uniform black, and the pectorals black, often with whitish base and a white margin. Older specimens lose much of this dark coloration, the peritoneum becoming silvery with sparse black specks, and the opercles appearing lighter owing to the thicker integuments masking the dark coloration of the lining membrane of the gill-cavity. The white margin of the pectorals and the light bar at the base widen at the expense of the black, until the latter is confined to a narrow bar on middle of fin, or may even disappear; a narrow black edging to the distal white bar develops secondarily. The terminal half of the outer ventral rays also become white. In adults, the black coloration of spinous dorsal is usually confined to a submarginal streak of nearly uniform intensity throughout, a distinct division into two well-separated blotches never occurring.

Other characteristics of the species are as follows:

Spinous dorsal normally XV (XIV to XVI), the fin higher, the outline angular, the third spine usually distinctly the longest, and much longer than any of the succeeding spines. Notch between dorsals not so deep as in *S. alascanus*, the last 1 or 2 (only rarely the last 3) spines again lengthened. Gill-rakers a little longer, 7 on upper limb of outer arch, 12 developed and 4 rudimentary on horizontal limb. Cephalic spines lower and more slender, only the posterior paroccipital well developed, the anterior either represented by 2 or 3 small points, or wholly undeveloped.

Spinous dorsal uniformly black (in young) or with a uniform submarginal streak, rarely with trace of interruption. Pectorals uniformly black with lighter base (in very young), or with black confined to a median bar, the base light, the terminal half light with narrow black margin. The black bar, where present, is uniform, not crossed as in *S. alascanus* by vertical light lines. The dark coloration of the pectorals may wholly fade in adults. Lining of gill-cavity and posterior portion of buccal cavity blackish.

The nasal cirrus develops as a flat fimbriate tentacle.

List of stations.

		<i>Fathoms.</i>
4306	Off San Diego.....	207-497
4307	.....do.....	169-496
4317	.....do.....	161-510
4322	.....do.....	110-199
4333	.....do.....	301-487
4336	.....do.....	518-565
4351	.....do.....	423-488
4353	.....do.....	628-640
4399	Near San Clemente Island.....	245-285
4400	.....do.....	500-507
4401	.....do.....	448-468
4402	.....do.....	542-599
4412	Near Santa Catalina Island.....	265-274
4421	Near San Nicolas Island.....	229-298
4517	Monterey Bay.....	750-766
4522	.....do.....	130-149
4530	.....do.....	755-958
4540	.....do.....	389-551
4542	.....do.....	331-456

As will be seen from this list, the species is much more abundant in southern California than *S. alascanus*, and occurs in deeper water.

SEBASTODES RHODOCHLORIS (Jordan and Gilbert).*List of stations.*

		<i>Fathoms.</i>
4310	Near San Diego.....	71-75
4339	.....do.....	241-369
4343	Off Coronado Islands.....	55-155
4410	Off Santa Catalina Islands.....	178-195
4414	.....do.....	131-162

The specimens vary much in the length and strength of the dorsal spines, in the prominence of the occipital ridges, and in the color of the dorsal region, the green wavy lines and spots being present in some specimens and apparently absent in others. There is also a difference in the amount of black pigment in the lining of the abdomen and gill-chamber. The maxillary and mandible are largely scaled in all the specimens, and resemble in this respect *S. umbrosus*, which I am unable at present to distinguish from *S. rhodochloris*. At the same time it is possible that more than one species is represented in the specimens here noted and can be distinguished when a large amount of material is brought together.

SEBASTODES AURICULATUS (Girard).

The young specimens, 280 mm. long, were taken with hook and line at anchorage in Wilson Cove, San Clemente Island. They are both without coronal spines and exhibit faint cross-bars downwards from back. They thus agree in essential characters with the northern form which has been recognized as *Sebastodes auriculatus dalli*.¹ As *S. dalli* was described from the vicinity of San Francisco and is now found to occur among the Santa Barbara Islands in company with typical *auriculatus*, the name is not available for a northern subspecies, if

¹ Jordan and Starks, Proc. Cal. Acad. Sci., 1895, p. 798.

such were found to exist. But the present form doubtless falls within the normal variation of *S. auriculatus*.

SEBASTODES MELANOPS (Girard).

Station 4497, near Santa Cruz, 11 to 14 fathoms.

SEBASTODES PINNIGER (Gill).

Station 4504, Monterey Bay, 10 fathoms.

SEBASTODES MINIATUS (Jordan and Gilbert).

Station 4441, Monterey Bay, 28–35 fathoms.

SEBASTODES ATROVIRENS (Jordan and Gilbert).

Station 4404, San Clemente Island, 15 fathoms. .

SEBASTODES SAXICOLA (Gilbert).

List of stations.

		Fathoms.
4322	Off San Diego.....	110–199
4343	.....do.....	55–155
4346	.....do.....	46–50
4357	.....do.....	134–155
4365	.....do.....	130–158
4439	Monterey Bay.....	40–42
4445	.....do.....	60–66
4455	.....do.....	56–62
4464	.....do.....	51–36
4475	.....do.....	58–142
4479	.....do.....	33–45
4485	.....do.....	39–108
4510	.....do.....	91–184
4518	.....do.....	66–140
4523	.....do.....	75–108
4534	.....do.....	76–86
4535	.....do.....	54–71

SEBASTODES ZACENTRUS (Gilbert).

Plate 16, fig. 7.

Sebastes deani STARKS, Ann. Carnegie Mus., vol. 7, 1911, p. 178, pl. 29, text fig. 9, Puget Sound.

This species has been heretofore known from Southern California and is here recorded from Monterey Bay and the vicinity of San Diego. It is identical with *S. deani* from Puget Sound, and is doubtless of general distribution along the coast in deep water. The following description is drawn from the Monterey specimen, 168 mm. long.

Most nearly related to *Sebastes saxicola* Gilbert, differing most conspicuously in the following respects:

- 1. Gill-rakers more numerous and crowded.
- 2. The lower posterior angle of subopercle and the contiguous upper posterior angle of interopercle without the conspicuous spines present in *S. saxicola*.
- 3. No spinous tips to lobes of preorbital.

4. But two suprascapular spines, the lower anterior spine wanting in this species but present in all specimens of *S. saxicola*.
5. Second anal spine much longer and more curved.
6. Pectorals shorter, not extending beyond tips of ventrals.
7. Two conspicuous dark bars diverging backwards from orbit.
8. Dark bars on body more pronounced.

Length of head from tip of upper jaw to the margin of opercular membrane 2.7 in total length without caudal; greatest depth of body 3. Length of snout 4 in head, equal to the least interorbital width; diameter of orbit 3; length of maxillary 2.2; length of second anal spine equal to length of snout and eye.

Dorsal, XIII, 14, the last ray cleft to base; anal, III, 7; pectoral normally of 9 divided and 8 lower simple rays, the type with 9 simple rays on one side. Pores in lateral line 41 on one side, 44 on the other.

Mandible strongly protruding, entering the profile, with a well-developed symphyseal knob; maxillary broad, subtending anterior three-fourths of the pupil; interorbital region broad, nearly flat, the supraorbital ridges but little elevated, the inner pair of frontal ridges inconspicuous, diverging backwards. Preocular spine strong; supraocular ridge short, depressed, ending in a well-marked postocular spine; tympanic spine present, inconspicuous; parietal ridges sharp but low, moderately diverging, ending in slender spines. Preopercular spines flattened, triangular, the upper three directed backwards, the fourth and fifth somewhat obliquely downwards. Suborbitals extremely narrow; preorbital with two rounded lobes, the posterior lobe with an obsolescent spinous point, or with none; subopercle and interopercle with spines obsolescent or wholly wanting. Teeth in narrow bands, those on palatines in about two rows; the anterior series in the premaxillaries a trifle enlarged.

Gill-rakers long and very slender, the longest half the orbital diameter, 10 or 11 on vertical limb, 24 on horizontal limb of outer arch; no immovable rudiments present.

Scales weakly ctenoid, those on head, breast, and along bases of vertical fins much reduced in size. Bands of very fine scales accompany the dorsal spines; fine scales envelop all the other fins nearly or quite to their margins. Top and sides of head wholly scaled, including snout, preorbital, maxillary, mandible, median portion of gular membrane, and the upper 4 branchiostegal rays. Pores in lateral line corresponding with the series of scales running very obliquely downward and backward from dorsal outline to lateral line.

Spinous dorsal low, evenly rounded, the membranes not deeply incised, the fourth and fifth spines about equal, 2.4 in length of head; outline of fin not deeply notched, the thirteenth spine equaling diameter of orbit, the twelfth more than two-thirds its length. Second anal spine very long and strong, much heavier and longer than

the third, its length 1.75 in head. Caudal emarginate. Ventrals extending a trifle beyond the vent, a little overpassing the pectorals.

General color reddish in life, a narrow brown streak on middle of sides. Irregular broad dusky bars extending on basal portion of dorsal fin and downward to below lateral line; one, ill-defined under nape and first two dorsal spines, another under fifth to seventh, a third under ninth to thirteenth dorsal spines, the second and third often confluent midway between base of dorsal and lateral line, then again separating, the second barely crossing lateral line, the third extending to middle of sides; a fourth and fifth occupy the greater part of base of second dorsal, confluent below; a sixth on caudal peduncle. Two dusky streaks diverge backward from eye, each ending in a black blotch, the upper on opercle, the lower on subopercle. Top of head, snout, and tip of mandible dusky. Caudal light at base and on upper and lower rays, with dusky olive streaks running principally on the membranes. Pectorals, ventrals, and anal unmarked. Peritoneum jet black.

Measurements in hundredths of total length without caudal:

Depth of body.....	34
Depth of caudal peduncle.....	10
Length of head.....	36.5
Length of snout.....	8
Interorbital width.....	8
Diameter of eye.....	12
Length of maxillary.....	16.5
Longest gill-raker.....	5
Length of fifth dorsal spine.....	15
Length of twelfth dorsal spine.....	8.5
Length of thirteenth dorsal spine.....	12.5
Length of second anal spine.....	22
Length of third anal spine.....	17.5
Length of pectoral.....	26.5
Length of ventral.....	23
Total length without caudal, in mm.....	138

A specimen from station 4377, near San Diego, depth 127 to 299 fathoms, 157 mm. long, appears bleached and shows faint indications only of the bands on body and the dark streaks behind eye. A very young specimen from station 4543, Monterey Bay, 53 to 93 fathoms, shows perfectly the characters of the species. Other specimens are from stations 4534 and 4543, Monterey Bay, depths 76 to 299 fathoms.

SEBASTODES WILSONI, new species.

Plate 16, fig. 8.

Type-specimen.—Cat. No. 75811, U.S.N.M., 145 mm. long, from station 4518, Monterey Bay, depth 66 to 140 fathoms.

Most nearly related to *S. semicinctus* Gilbert, differing most obviously in the following respects:

1. Coloration more uniform, the very conspicuous bars of *S. semicinctus* entirely wanting on sides of body, as are also the brownish spots present in *semicinctus* on back and on dorsals and caudal.

2. The more numerous gill-rakers.

3. The absence of spines on the contiguous angles of subopercle and interopercle.

4. The arrangement of the upper three preopercular spines, which are all horizontal, the second nearer the third than the first; in *S. semicinctus* the second spine is much nearer the first than the third, and the third is directed obliquely downward and backward.

5. The presence of 6 anal rays in both type and cotype; 7 are present in *S. semicinctus* in all the numerous specimens examined.

Length of head, from tip of snout to end of opercular flap, 3 in total length without caudal; depth, 3.7; least depth of caudal peduncle, 3.8 in length of head; diameter of orbit, 3.3; least interorbital width, 5.4; length of snout, 4.2; distance from tip of snout to end of maxillary, 2.4; longest gill-raker half diameter of orbit. Gill-rakers, 13 + 30 (or 13 + 29) on outer arch.

Dorsal, XIII, 14; anal, III, 6; pectoral, 17, the lower 8 rays thickened and simple; pores in lateral line, 42 to 44, corresponding to the oblique series downward and backward from dorsal outline.

Body very slender, more so than in *S. semicinctus*, the only species which approaches it in this respect. Snout sharp, the head evenly tapering, the mandible strongly protruding, its tip extending beyond the line of upper profile, the symphyseal teeth on a projection which fits into a toothless notch above. Maxillary broad, subtending slightly less than anterior half of eye. Interorbital area flat, or rendered slightly concave by the depressed supraorbital ridges; pair of inner frontal ridges very inconspicuous. Preocular and postocular spines strong but low; tympanic spines low; parietal ridges narrow and sharp, with low, strong spines. Upper 4 preopercular spines directed backward, the fifth directed a little downward; space between second and third spines shorter than other interspaces. Preorbital with two rounded lobes, which fail to develop distinct spines. Contiguous angles of subopercle and of interopercle without spines. Two strong suprascapular spines, the lower posterior spine with an additional one anterior to its base. Palatine and mandibular bands of teeth very narrow, the latter widening abruptly at symphysis, where the teeth also increase in size.

Scales strongly ctenoid, reduced in size in head and breast, and along base of dorsal fins; accessory scales apparently not numerous. Head entirely scaled, including snout, preorbital, maxillary, mandible, gular membrane mesially, and the branchiostegal rays. A band of scales accompanies each dorsal spine; all segmented rays are invested with fine scales to their tips.

Spinous dorsal low, the spines rather strong, the membranes not deeply incised. Second anal spine decidedly longer and stronger than the third, equal in length to the first soft ray, its length equaling distance from tip of snout to posterior margin of orbit. Caudal gently concave. Pectoral rather short, barely attaining vertical from vent, the longest ray 1.2 in length of head; 17 rays are present, the lower 8 thickened and simple, the others slender, all but the uppermost divided.

Color in spirits generally light, the opercles, breast, and ventral region white. Rather faint dark bars along upper profile, one on occiput, one at beginning of spinous dorsal, one at its middle and one near its end, two under second dorsal, and one on back of caudal peduncle; a narrow brownish-red streak or line runs below the lateral line and nearly parallel with it to opposite end of anal fin. The dark blotches along base of dorsals extend on the basal portions of these fins; membranes of caudal fin with a few dark streaks; fins otherwise unmarked. Mouth and gill cavity white. Peritoneum black.

Measurements in hundredths of total length without caudal:

Depth of body.....	28
Depth of caudal peduncle.....	8
Length of head.....	33
Length of snout.....	8
Length of maxillary.....	13.5
Interorbital width.....	6
Diameter of orbit.....	11
Longest gill raker.....	5
Length of longest (fifth) dorsal spine.....	14
Length of twelfth dorsal spine.....	6.3
Length of thirteenth dorsal spine.....	9
Length of second anal spine.....	17.5
Length of third anal spine.....	13
Length of pectoral.....	27
Length of ventral.....	20
Total length without caudal, in mm.....	121

A single paratype, 105 mm. long, from station 4518, Monterey Bay, depth 66 to 140 fathoms.

I take pleasure in naming this species for Prof. C. B. Wilson, in recognition of his valuable contributions to our knowledge of the crustacean parasites of fishes.

SEBASTODES SEMICINCTUS (Gilbert).

Station 4518, Monterey Bay, 66-140 fathoms.

SEBASTODES DIPLOPROA (Gilbert).

List of stations.

		<i>Fathoms.</i>
4306	Off San Diego.....	207-497
4339	.....do.....	241-369
4357	.....do.....	134-155
4365	.....do.....	130-158
4413	Off Santa Catalina Island.....	152-162
4423	Off San Nicolas Island.....	216-339
4510	Monterey Bay.....	91-184
4523	.....do.....	75-108

SEBASTODES AURORA (Gilbert).

Station 4418, off Santa Barbara Island, 238-310 fathoms.

A rather wide variation is found in the size and shape of the second anal spine and in the robustness and the length of the gill rakers. The second anal spine varies from straight to strongly curved and varies in length from half to two-sevenths the length of the head. The gill rakers are sometimes slender, sometimes much more robust, and vary in length from two-fifths to four-sevenths the diameter of the eye. Similar differences are found among the type-specimens of the species.

In addition to the color already described, the species has in life 3 faint red bars, 2 under spinous and 1 under soft dorsal. Young specimens have a dark blotch under soft dorsal in the course of the red bar.

SEBASTODES INTRONIGER (Gilbert).

List of stations.

		<i>Fathoms.</i>
4339	Off San Diego.....	241-369
4410	Off Santa Catalina Island.....	178-195
4418	Off Santa Barbara Island.....	238-310

As is usual in adults of this species, the second anal spine is apparently a little shorter than the third, failing to reach the tip of the third when declined, although the actual measured length of the two is about the same. In the young the second spine appears equal to the third, and its measured length is a little greater. The specimens in the present collection bear out the alleged differences between this species and *S. melanostomus*, the head being less than one-third the total length, the interorbital width less than one-fifth the length of the head, the lateral line 30 to 32 and the gill rakers one-half to two-fifths the diameter of the eye. No specimens answering the description of *S. melanostomus* have been taken by the *Albatross*, and none but the type is known. It may well prove that the alleged differences between the two species are due to errors in the original description of *S. melanostomus*, in which case the name *introniger* will give way to *melanostomus*.

SEBASTODES RUBERRIMUS Cramer.

A few immature specimens were taken at the following stations:

		<i>Fathoms.</i>
4460	Monterey Bay.....	55-167
4463	.....do.....	48-111
4518	.....do.....	66-140

SEBASTODES ROSACEUS (Girard).

Station 4420, off San Nicolas Island, 32-33 fathoms.

SEBASTODES RUPESTRIS (Gilbert).

List of stations.

4410	Off Santa Catalina Island.....	<i>Fathoms.</i> 178-195
4411	.....do.....	143-245

SEBASTODES ELONGATUS (Ayres).

List of stations.

4307	Off San Diego.....	<i>Fathoms.</i> 169-496
4340	.....do.....	46-87
4343	.....do.....	55-155
4346	.....do.....	46-50
4349	.....do.....	75-134
4377	.....do.....	127-299
4408	Off Santa Catalina Island.....	104-117
4414	.....do.....	131-162
4460	Monterey Bay.....	55-167
4518	.....do.....	66-140

SEBASTODES RUBRIVINCTUS (Jordan and Gilbert).

Station 4417, off Santa Barbara Island, 29 fathoms.

SEBASTODES VEXILLARIS (Jordan and Gilbert).

Station 4346, off San Diego, 46-50 fathoms.

Dorsal, XIII, 13; maxillary not reaching beyond orbit; scales in lateral line, 46; second anal spine four-ninths length of head.

SCORPAENA GUTTATA Girard.

Station 4346, off San Diego, 46-50 fathoms.

OPHIODON ELONGATUS Girard.

In young specimens it is clearly seen that the first 3 anal rays are slender short spines, the first 2 of these becoming embedded and concealed in adults. These facts have been verified on immature specimens in the present collection and on a specimen 24 cm. long, in which the spines could not be distinguished without dissection.

List of stations.

4442	Monterey Bay.....	<i>Fathoms.</i> 26-31
4459	.....do.....	13-15

ZANIOLEPIS LATIPINNIS Girard.

In 2 specimens, 150 and 152 mm. long to base of caudal, measurements in hundredths of this length are as follows: Length of head, 24 and 24.5; depth of body, 18 and 18.3; length of snout, 7 and 7; diameter of eye, 6.5 and 6.5; length of maxillary, 8.5 and 8.5; interorbital width, 4 and 3.5.

There are either 21 or 22 dorsal spines and constantly 11 soft rays. The anal has 15 or 16 rays in all specimens examined, and the pectorals 13, 14, or 15 rays.

List of stations.

		<i>Fathoms.</i>
4453	Monterey Bay.....	49-51
4473	.....do.....	54-65
4476	.....do.....	25-39
4492	.....do.....	26-27

ZANIOLEPIS FRENATUS Eigenmann.

In a specimen, 151 mm. to base of caudal, the length of head is 25 hundredths of this length; length of snout, 7; diameter of eye, 6.5; length of maxillary, 8; interorbital width, 2.8; depth of body, 18. Fin rays are as follows: Dorsal, XX-I, 13; anal, III, 17; pectoral, 15; ventral, I, 5.

A young specimen, 82 mm. long, has the interorbital space wider and less furrowed, the entire lower side of head, including gular membranes and branchiostegal rays, closely and completely scaled, and the dorsals with black blotches and bars, but without the small round black spots characteristic of adults.

List of stations.

		<i>Fathoms.</i>
4310	Off San Diego.....	71-75
4452	Monterey Bay.....	49-50
4554	.....do.....	60-80

OXYLEBIUS PICTUS Gill.

Station 4441, Monterey Bay, 26-39 fathoms.

ANOPLPOMA FIMBRIA (Pallas).

A single immature specimen, 75 mm. long, was taken at the surface at station 4518, Monterey Bay.

The 3 anterior anal rays are evidently non-articulated and spinous in the young; in adults they are imbedded and concealed and their character is difficult to determine.

Coloration of the young is peculiar. The distal half of upper pectoral rays is jet black, contrasting sharply with the white basal portion. The anterior dorsal rays and the caudal are largely black.

CHITONOTUS PUGETENSIS (Steindachner).

List of stations.

		<i>Fathoms.</i>
4420	Off San Nicolas Island.....	32-33
4453	Monterey Bay.....	49-51
4476	.....do.....	25-39
4558	.....do.....	28-40

The genus *Chitonotus* differs from *Icelinus* and *Tarandichthys* in having 3 instead of 2 ventral rays.

TARANDICHTHYS FILAMENTOSUS (Gilbert).

Pectorals 17, the lower 8 thickened, with moderately exserted tips, the upper protruding a little beyond the outline of fin. Ventrals I, 2.

List of stations.

		<i>Fathoms.</i>
4310	Off San Diego.....	71-75
4476	Monterey Bay.....	25-39
4543	.....do.....	53-93

TARANDICHTHYS TENUIS (Gilbert).

In addition to other striking characters in this species, it is marked by two sharp, strong spines behind the base of the supraocular filament. These are still more strongly developed in *T. cavifrons*, but are wanting in *T. filamentosus*. In adults the lower 8 pectoral rays are thickened, with moderately incised membranes, the upper of these modified rays projecting abruptly beyond the margin of the fin.

Fin rays in 7 specimens are as follows:

	Dorsal spines.	Dorsal rays.			Anal rays.				
	X	16	17	18	13	14	15	16	17
Specimens.....	7	1	3	3	1	1	3	1	1

Ventrals constantly I, 2.

List of stations.

		<i>Fathoms.</i>
4309	Off San Diego.....	67-78
4310	.....do.....	71-75
4535	Monterey Bay.....	54-71
4558	.....do.....	28-40

ICELINUS QUADRISERIATUS (Lockington).

There is a single filament near tip of maxillary, a broad one above posterior part of orbit, and a few scattered ones along lateral line. In males the anal, ventrals, and the lower pectoral rays are blackish, as well as the branchiostegal membranes.

The normal fin formula is dorsal IX, 14; anal, 12; pectoral, 16 (7+9). As in other species of *Icelinus*, the ventrals are I, 2, not I, 3, as given in current descriptions.

In 16 specimens the fin rays are as follows:

	Dorsal spines.		Dorsal rays.		Anal rays.			Pectorals.	
	VIII	IX	13	14	11	12	13	7+9	8+8
Specimens.....	1	15	3	13	2	11	3	11	5

The dorsal series of plates is almost universally interrupted under the end of soft dorsal. In two specimens of this collection the series is not interrupted, becoming single at the spot where the break commonly occurs.

List of stations.

		<i>Fathoms.</i>
4304	Off San Diego.....	25
4346	.....do.....	46-50
4347	.....do.....	55-58
4442	Monterey Bay.....	26-31
4452	.....do.....	49-50
4476	.....do.....	25-39
4477	.....do.....	11-19
4479	.....do.....	33-45
4487	.....do.....	18-19
4489	.....do.....	18-20
4490	.....do.....	16-20
4492	.....do.....	26-27
4519	.....do.....	27-35
4520	.....do.....	32-44
4557	.....do.....	53-54
4558	.....do.....	28-40

ICELINUS FUSCESCENS, new species.

Plate 17, fig. 9.

Type-specimen.—Cat. No. 75812, U.S.N.M., a female, 107 mm. long, from station 4418, off Santa Barbara Island, depth 260 to 310 fathoms.

Measurements in hundredths of total length to base of caudal: Length of head, including opercular flap, 39; width of head, 22; greatest depth of bony interorbital width, 3; diameter of orbit, 11.5; length of upper preopercular spine, 7; distance from tip of snout to margin of gill-membrane, 24.5; to front of spinous dorsal, 34; to front of second dorsal, 32.5; base of anal, 21.5; length of caudal peduncle, 21; longest dorsal spine, 12; longest dorsal ray, 26; longest anal ray, 13.5; length of pectoral, 24.5; length of ventral, 5; length of caudal, 19.5; greatest depth of body, 23.5; depth of caudal peduncle, 7.

Dorsal, X, 16; anal, 12; pectoral 18, the lower 10 rays thickened; ventral, I, 2, as in all other species of the genus, not I, 3, as commonly stated.

Head heavy, quadrate in cross section, the cheeks vertical; interorbital space narrow, flat, or with an obscure median ridge, its width about half diameter of pupil; nostril in a short tube; no nasal filament; a short cutaneous flap, narrowed at base and palmately cleft, posteriorly on upper orbital rim; a slender filament at end of occipital ridge, and a small flap midway between this and the supraorbital flap; a minute filament superiorly near the tip of the maxillary, and one in advance of upper end of gill-cleft; no filaments along lateral line; maxillary reaching vertical from posterior margin of pupil; palatine patches of teeth comparatively short and broad, their length about half the transverse width of the vomerine patch; nasal

spines inconspicuous, their tips acute, not cleft; upper preopercular spine rather slender, of moderate length, with three short backwardly-hooked barbs in addition to the terminal spine; preopercular margin below with three sharp spines, the upper directed backward, the lower downward and forward; no spinous point on subopercle; occipital ridge short, rugose, not ending in a free spine; sensory canals and pores on head much larger than in any other species, in accordance with its deeper habitat; the pair of pores below the mandibular symphysis open into a common pit with slightly raised margins.

Dorsal series of plates shorter than in related species, beginning under middle of spinous dorsal and ending a little in advance of end of soft dorsal, the last few plates being single; no plates on back of caudal peduncle; the dorsal row contains 20 to 22 plates. Lateral line with 36 large pores. No plates behind axil of pectorals.

Spinous dorsal low, none of the spines produced, a very short interspace between the dorsals. Pectoral wider than in other species, with 18 rays, reaching slightly beyond the vent; ventrals extremely short, not exceeding the diameter of the pupil, composed of 1 spine and 2 rays, as always in this genus; caudal broadly rounded.

Dusky olive throughout, but little lighter below; from base of soft dorsal 2 broad black bars descend to below the lateral line, the anterior sending a narrow prolongation forward from the lower anterior angle; a less evident black bar extends downward and forward from the spinous dorsal. Soft dorsal black, with a narrow white edge and a small light area at base above the interval between the black bars; 2 vertical black bars on spinous dorsal, the interval light; caudal black, with a narrow white margin; pectoral black, a lighter area at tips of upper rays and a broad light half-bar descending almost vertically from base of upper rays; the shortened lower rays are light, as are the tips of all the rays; ventrals dark. Occipital filaments black, maxillary filament white.

The paratypes are smaller than the type and much lighter in color, all the fins translucent with darker bars and mottlings, the pectoral with a large black blotch on lower half; an evident Y-shaped dark mark at base of tail.

List of stations.

		<i>Fathoms.</i>
4410	Off Catalina Island.....	178-195
4418	Off Santa Barbara Island.....	238-310
4421	Off San Nicolas Island.....	229-291
4471	Monterey Bay.....	65-303

RADULINUS ASPRELLUS Gilbert.

This species has been dredged previously by the *Albatross* at numerous stations off the coasts of Washington, Oregon, and northern

California at depths of 38 to 93 fathoms. The most southerly station has been 3194, off Port Harford, California, the species having been unknown south of Point Conception. The present collection contains a specimen from station 4343, near the Coronado Islands, south of San Diego.

In their description of the species, Jordan and Evermann state that there are two opercular spines and that the interorbital space is armed with spinous plates. The opercle is, however, without ridge or spines and the greater part of the interorbital space is unarmed, its posterior portion only receiving an incursion from the postocular patch of scales. The eye is variable, its diameter contained from 2.6 to 3.3 times in the length of the head.

List of stations.

		<i>Fathoms.</i>
4343	Off San Diego.....	55-155
4452	Monterey Bay.....	49- 50
4453	.....do.....	49- 51
4554	.....do.....	60- 80

ZESTICELUS PROFUNDORUM (Gilbert).

Known hitherto from four specimens captured by the *Albatross* north of Unalaska and in the vicinity of Bogoslov Island. A single specimen is in the present collection, taken at station 4547, off Monterey, at a depth of 1,083 fathoms. The Bering Sea specimens were from 399 and 664 fathoms, indicating a very exceptional vertical range.

The fin-rays agree with the Bogoslov specimen: Dorsal, VI, 10; anal, 8; pectoral, 20; ventral, I, 2. The types from north of Unalaska had longer fins, one of these in the collection of Stanford University (No. 3025) having dorsal, VI, 12; anal, 10; pectoral, 20; ventral, I, 2. As will be noted, the ventrals have constantly 2 soft rays, instead of 3, as indicated in all previous descriptions of the species.

In the California specimen the preopercular spine is almost perfectly straight and reaches to or nearly to the margin of opercular membrane. In the cotype above mentioned the spine is less curved than is represented in the figure of the type-specimen.¹ The mouth is also slightly smaller in the California specimen, barely passing front of pupil, and the head is shorter, 2.6 in length, without caudal.

The lateral line has anteriorly two series of pores, widely separated, the upper series much smaller than the lower and approaching the lower on middle of sides, where it usually disappears. Posteriorly, the lateral line terminates in a large pore at base of caudal.

¹ Report U. S. Fish Com., 1896, pl. 27.

AVERRUNCUS EMMELANE Jordan and Starks.

Xystes axinophrys JORDAN and STARKS, Proc. Cal. Acad. Sci., ser. 2, vol. 5, 1895, p. 824, pl. 92.

Station 4520, Monterey Bay, 32–44 fathoms.

A single young specimen from the above station affords a notable extension in the range of this species, known hitherto only from Puget Sound. The fin-rays are as follows: Dorsal, X, 8; anal, 12; pectoral, 14; ventral, I 2.

Examination of the type of *Xystes axinophrys* Jordan and Starks has shown that it is based on a very young individual of *Averruncus emmelane*.¹ The only full characterization of *Xystes* is that given by Jordan and Evermann.² It is said to differ from *Averruncus* by the shorter vertical fins, the last rays of which are without posterior membrane; the progressively shortened lower rays of the pectorals; the absence of barbels or nuchal pit; the presence of a strong knife-like spine above eye. The vertical fins are, however, of the same length, the fin formula agreeing exactly (the anal fin in the type of *Xystes* having 11 instead of 10 rays). The last rays of dorsal fins are attached by posterior membrane, as in related forms, this membrane ruptured in the type of *Xystes*. The lower pectoral rays are progressively shortened in the young of all Agonoids, a specimen of *A. emmelane* from Annette Island, Alaska, 105 mm. long, showing as yet no trace of the elongation of these rays. Barbels are present in the type of *X. axinophrys*, covering the lower jaw and the branchiostegal membranes and agreeing in position with those in *A. emmelane*. A nuchal pit is present, though less developed than in adults. All the spines on head are larger in the young, but those in *X. axinophrys* agree wholly in number and position with those in *A. emmelane*. There can be no doubt of the identity of the two species.

Averruncus sterletus Gilbert should probably be referred to the genus *Agonopsis*, which appears to differ from *Averruncus* in the shorter vertical fins and the subequal jaws, the rostrum not conspicuously protruding. The latter character is not very important, and the two genera eventually may be united.

ASTEROTHECA, new genus (*Agonidae*).

Type of the genus.—*Xenochirus pentacanthus* Gilbert.³

Like *Xeneretmus* (for *Xenochirus* Gilbert, preoccupied) in all respects except that the terminal rostral plate is very small, not projecting beyond the premaxillaries, and bears 5 small spines, 3 of which diverge upward and backward and 1 projects freely at each

¹ See also Starks, Ann. Carnegie. Mus. vol. 7, 1911, p. 195.

² Fishes of North America, p. 2076.

³ Proc. U. S. Nat. Mus., vol. 12, 1890, p. 91.

lateral angle. A minute spine may also be present in the median line directed forward.

The dorsal fin is inserted normally on the eighth plate of the dorsal series, but may occasionally vary to the extreme posterior edge of the seventh (*pentacanthus*), or the anterior edge of the ninth (*alascanus*).

The genus is perhaps nearer *Bathyagonus* than *Xeneretmus*, agreeing with the latter in the character of the rostral plate, and in the number of predorsal plates. But *Bathyagonus* is from deeper water, the whole body and the fins are black or brownish black, the mandible is produced beyond the premaxillaries instead of being included within the latter, and the pectoral margin is entire—the lower rays not appreciably lengthened.

Key to species of Asterotheca.

- a*¹. Plates on cheeks thick, inflexible, immovably united with each other and with the interopercle. Lower 5 pectoral rays thickened. A single median pair of plates in front of ventrals, the remaining plates of median series unpaired (i. e., the plates of the second pair fused). Shallow water species, with comparatively thick plates and heavy spines and ridges, and the lower parts light in color.
- b*¹. Margin of preorbital not spinous. Ventrolateral series of plates smooth throughout, without spines; spines of lower lateral series weak or obsolescent, this especially marked on caudal peduncle. A deep nuchal depression. Space between dorsal ridges deeply concave. Plates on cheeks, in adults, without spines or tubercles. Gill-membranes without posterior free margin. Lower pectoral rays much exerted beyond the membrane, a distinctly deeper notch between the two portions of the fin. No spine on infraorbital ridge below front of eye.....*alascana*.
- b*². Lower margin of preorbital strongly spinous in adults. Anterior plates of ventrolateral series with short but evident spines; lower lateral plates all strongly spinous, except the anterior 5 or 6, which are smooth as in other species. Plates on cheeks with minute spines. A small spine on infraorbital ridge below front of eye. Nuchal depression shallow. Space between dorsal ridges shallowly concave. Gill-membranes with a narrow free margin posteriorly. Lower pectoral rays comparatively little exerted, no conspicuous notch between the two portions of the fin.....*infraspinata*.
- a*². Plates on cheeks thin, flexible, not fused, readily movable, all (or the posterior two) bearing each a strong backwardly directed spine. Ventrolateral series of plates sharply spinous throughout, as are the lower lateral series, with the exception of the first 5 or 6. Two median pairs of plates in front of ventrals. Lower 4 pectoral rays thickened, a deep notch between the two portions of the fin. A deeper water species, with comparatively thin plates, low ridges, and delicate sharp spines; lower side of trunk and tail dark like the back; eye very large. Spines on eye-ball weak or obsolescent. Palatine patches of teeth narrower than those on mandible.....*pentacantha*.

ASTEROTHECA PENTACANTHA (Gilbert).

The fin-rays in 18 specimens vary as follows:

	Dorsal spines.			Dorsal rays.			Anal rays.		
	VI	VII	VIII	8	6	7	6	7	8
Specimens.....	3	11	4	2	7	9	1	11	6

List of stations.

		<i>Fathoms.</i>
4306	Off San Diego.....	207-497
4307	do.....	169-496
4258	do.....	167-191
4366	do.....	176-181
4410	Off Catalina Island.....	178-195
4413	do.....	152-162
4421	Off San Nicholas Island.....	229-298
4423	do.....	216-339
4510	Monterey Bay.....	91-184
4523	do.....	75-108
4533	do.....	144-293

Genus *XENERETMUS* Gilbert.

Key to species of Xeneretmus.

- a*¹. A single upright spine on terminal rostral plate. First dorsal spine inserted on seventh plate of dorsal series, or occasionally on the extreme anterior edge of the eighth.
- b*¹. *Xenopyxis*.¹—Cheek below suborbital crest naked, without plates. Only one spine developed on preopercular margin. Membrane between thickened modified and normal unmodified pectoral rays not more deeply notched than between other rays. Terminal rostral plate not ending at each side in a free spine. No blue spots.
- c*¹. A single barbel at tip of maxillary. Branchiostegal membrane with a wide free fold posteriorly. Pectoral rays 14 in number, 4 or 5 of the lower rays thickened. Plates on breast reduced in adults, the anterior usually not in contact. Body slender; spines slender. No black bar on base of dorsal fins.
- d*¹. A series of 3 to 5 spines on eye-ball. Adults with a well-developed series of paired plates behind vent. Modified pectoral rays 5 (rarely 6) in number, none of them greatly produced beyond the succeeding rays, the notch shallow between modified and unmodified portions of fin. Posterior margin of gill-membranes forming a curve on middle of throat. Spinous dorsal with a narrow jet-black margin of equal width throughout. Sides without conspicuous dark blotches. Median series of plates on caudal peduncle 14 to 16 in number. Dorsals more posteriorly inserted.....*latifrons*.
- d*². No spines on eye-ball. Series of paired plates behind vent very inconspicuous. Modified pectoral rays 4 in number, the uppermost much produced beyond the succeeding rays, a deep notch between modified and unmodified portions of fin. Posterior margin of gill-membranes angulated on middle of throat. Spinous dorsal with jet-black margin, which widens anteriorly to include greater part of fin. Sides with conspicuous dark blotches. Median series of plates on caudal peduncle 17 or 18 in number. Dorsals more anteriorly inserted.....*leiops*.
- c*². Two barbels at tip of maxillary. Branchiostegal membrane posteriorly with extremely narrow free fold. Pectoral rays 16 in number, the lower 6 or 7 thickened, the fin without deep notch. Body deep; spines strong. A black bar on base, as well as on margin of dorsal fins.....*ritteri*.
- b*². *Xeneretmus*.—Cheek below suborbital crest with three plates. Two preopercular spines developed. Pectorals with 13 rays, the 4 lower rays thickened and produced, the membrane between ninth and tenth rays deeply notched, the notch extending about halfway to base of ninth ray. Terminal rostral

¹ *Xenopyxis* Gilbert, new subgenus, type, *Xeneretmus latifrons*.

plate more freely movable, each lateral prolongation terminating in a short free spine. Small plates present on gill membranes and on gular membrane. Gill membrane without free fold. Two maxillary barbels. Small blue spots present on head and anterior part of trunk. Dorsal fins without dark bars at base or tip. *triacanthus*.

XENERETMUS LATIFRONS (Gilbert).

The principal distinctive characters of this species have been indicated in the preceding key and in the comparison with *X. leiops*. The following may be added:

The anterior 5 or 6 plates of lower lateral series spineless; ventral series becoming spineless from 1 to 4 plates in front of origin of anal fin. Patch of vomerine teeth wide, crescentiform, the posterior margin concave; palatine bands wider than those in the jaws. Sides with faint traces only of darker bars. Inferior surfaces whitish throughout, the lower side of tail not dusky. No bright spots. Spinous dorsal with a well-defined jet-black margin of uniform width throughout. Rays of soft dorsal and caudal dusky, a narrowly elliptical patch of the membrane bordering each ray dusky in the distal half of the fins. Posterior part of buccal cavity blue-black.

As is usual in this group, there are two pairs of plates on breast in front of the base of ventral fins. In addition, there is a small unpaired plate which varies in position, being sometimes wholly posterior to the paired plates; sometimes farther forward interposed between the plates of the posterior pair.

In a young specimen 44 mm. long the breast plates are elevated centrally and bear each a short spine. The vent is more posteriorly placed than in adults, being but little in advance of the tips of the ventral fins. Beginning immediately behind the ventrals is a double series of 12 small plates, each bearing a central prominence. With increasing age the vent passes forward between these two series.

The cheeks are normally without plates; two specimens only of the many examined had each a single plate on one side below the suborbital ridge.

In 26 specimens examined the fin-rays vary as follows:

	Dorsal spines.		Dorsal rays.			Anal rays.	
	VI	VII	6	7	8	7	8
Specimens.....	6	20	1	23	2	23	3

The median plates on caudal peduncle are as follows in 24 specimens:

	14	15	16
Specimens.....	6	16	2

The species was taken abundantly at the following stations:

		<i>Fathoms.</i>
4322	Off San Diego.....	110-199
4356	.....do.....	120-131
4357	.....do.....	134-155
4358	.....do.....	167-191
4365	.....do.....	130-153
4366	.....do.....	176-181
4455	Monterey Bay.....	56-62
4472	.....do.....	59-71
4475	.....do.....	58-142
4477	.....do.....	11-19
4480	.....do.....	53-76
4485	.....do.....	45-109

From this list it appears that the species lives at greater depths to the southward, off San Diego, than in the vicinity of Monterey Bay. The few specimens which have been dredged on previous expeditions off the Oregon coast were also in comparatively shallow water. The rule is, however, not without exceptions. Thus at stations 2972 and 2973 of a previous expedition the species was taken in the Santa Barbara Channel at depths of 61 and 68 fathoms; and at stations 3129, 3161, 3189, 3193, 3204, 3206, and 3209 it has been taken between Point Conception and Monterey Bay at the following depths: 204, 191, 218, 160, 202, 169, and 141 fathoms.

Measurements in hundredths of length, without caudal.

	Station 4472.	Station 4455.
Length of head, including opercular flap.....	22	21
Length of snout.....	6	6
Diameter of eye.....	7.5	7.1
Interorbital width.....	2.5	2
Greatest width of head.....	12.5	12.5
Depth at occiput.....	10.5	9.5
Length of maxillary.....	6.2	6
Distance between angles of mouth.....	5	5.5
Width at axil of pectorals.....	10	10.5
Depth of body.....	11.5	11
Length of caudal peduncle.....	41.5	41
Predorsal length.....	32	31.2
Length before second dorsal.....	51	50
Preanal length.....	47.5	46
Length of first pectoral ray.....	15.5	17
Length of eighth pectoral ray.....	14	15.5
Length of ninth pectoral ray.....	15	16
Length of tenth pectoral ray.....	17	18
Length of eleventh pectoral ray.....	17.1	17.5
Length of fourteenth pectoral ray.....	9	10
Length of ventrals.....	9	9
Length of caudal.....	11	11.5
Longest (first) ray of second dorsal.....	13	14
Total length in millimeters.....	136	158
Length to base of caudal, in millimeters.....	123	142

XENERETMUS LEIOPS, new species.

Plate 17, fig. 10.

Type-specimen—Cat. No. 75813, U.S.N.M., 176 mm. long, from station 4410, off Catalina Island, southern California, depth 178 to 195 fathoms.

Very close to *X. latifrons*, differing in the coloration, the more slender form with longer caudal peduncle, the much longer lower lobe of the pectoral fin, the reduction of the plates on the breast and behind the vent, and the absence of the series of spinelets on the eyeball, characteristic of all other known species of the genus.

Dorsal, VI, 7; anal, 7; pectoral, 14; lateral line, 43.

Head short and broad, the greatest depth eight-tenths the greatest width. Snout short, broadly triangular on its dorsal aspect, marked by a transverse depression behind the nasal spines. A shallow transverse depression behind the eyes and a deeper one behind the occiput. Width and depth of the body about equal under the middle of the spinous dorsal.

Ridges and spines similar to those in *X. latifrons*, but not so strong. Interorbital space shallowly concave, narrow, without secondary ridges. No preocular spines; a pair of slender postoculars; 2 pairs of occipitals; a pair on the shoulder; nasal spines strong. The plate at tip of snout freely movable, bearing a single strong erect spine, somewhat curved backwards; lateral angles of the plate bound down by the integument, not terminating in free spines. A single slender spine near posterior end of subocular ridge, and one behind it at angle of preopercle. Opercular ridge weak, the striations which diverge from the ridge above and below and cover the opercle in *latifrons* nearly or quite obsolete in this species. Margin of preopercle entire. Cheek below the subocular ridge unarmed, without plates or prickles. Eye very large, 2.75 in head, the surface wholly smooth, without trace of the strong spinelets present on *latifrons* and other species.

Mouth horizontal, broadly U-shaped, the maxillary extending slightly beyond the front of the eye. Teeth in broad villiform bands on the jaws; vomer with a subcircular patch, truncate posteriorly; palatines with well-developed lenticular patches, as broad as the mandibular band. A single long white maxillary barbel (forked at tip on one side, in the cotype) and one or two pairs of short mandibular barbels arising from the margins of the anterior pores. Gill membranes with a wide free margin posteriorly.

Plates and spines essentially as in *latifrons*, but the spines more slender; in the ventral series, only a few of the anterior plates bear spines, and in the dorsal series the plates are smooth opposite the posterior portion of the soft dorsal; with these exceptions, all the

series are spinous throughout. A few imbedded plates between the mandibular rami. Breast plates thin, flexible, scale-like, with concentric rings and weak radiating lines, so reduced that the anterior ones, at least, are not in contact. The paired postanal plates, so strongly developed in *latifrons*, are in this species obsolescent or wanting, or concealed beneath the integument.

Vertical fins inserted more anteriorly than in *latifrons*, the distance from tip of snout to front of dorsal two-sevenths the total length to base of caudal (one-third that distance in *latifrons*). First dorsal spine inserted on the seventh plate, the last spine on the twelfth; first ray of second dorsal on the seventeenth, the last ray on the twenty-second. Behind the last dorsal ray are 18 or 19 plates (always 16 in *latifrons*). Anal inserted one plate in advance of the second dorsal. Spinous dorsal and anal convex in outline, the second dorsal emarginate. Pectoral deeply notched, the lower four rays greatly thickened, the uppermost of these modified rays the longest, the slender ray above it only two-thirds its length. In *latifrons* the posterior margin of the pectoral nearly truncate, the lower 5 rays thickened, the upper modified ray but little produced beyond the one above it. Ventrals short, reaching less than one-third the distance to front of anal, the vent immediately behind their base.

Color dusky olive, whitish on breast and underside of head and on lips. Tip of snout, a blotch below the eye, and preopercles blackish. A black blotch downward from shoulder, involving base of upper pectoral rays. A series of oblong black blotches on sides, varying somewhat in number, size, and position. Basal portion of spinous dorsal white, the margin broadly black, the black area extending down nearly to base anteriorly on the membrane between first and second spines. Basal half of second dorsal translucent whitish, the distal half black, the two areas separated by a horizontal line. Caudal rays black throughout, the membranes lighter. Ventrals white; pectorals with the membranes light, the rays dark.

Measurements in hundredths of length to base of caudal:

	<i>Leiops</i> type.	<i>Leiops</i> cotype.	<i>Latifrons</i> Station 4480.
Length of head.....	20.8	21	21
Length of snout.....	6	6	6
Diameter of eye.....	7.3	8	7.5
Interorbital width.....	1.9	2	2.9
Width of head.....	12	12	13
Depth at occiput.....	9	9.5	10.5
Length of maxillary.....	6	6.5	6.5
Width of mouth.....	5.5	6	5.9
Width of body at axil.....	8.5	8.8	10
Greatest depth of body.....	10.5	10	11.3
Length of caudal peduncle.....	42	45	41
Distance from tip of snout to front of—			
First dorsal.....	28.5	30	34
Second dorsal.....	45	45	47
Length of tenth pectoral ray.....	11	13.5	16.9
Length of eleventh pectoral ray.....	17	19	16.5
Total length without caudal, in millimeters.....	169	133	132

Known only from the type and a single paratype from the same station.

X. latifrons.

1. No black blotches on sides.
2. Black margin of spinous dorsal of uniform width.
3. 14 to 16 plates in median series behind dorsals.
4. A series of 4 to 6 strong spinelets on eyeball.
5. 3 to 5 pairs of well-developed postanal plates.
6. Plates on breast stronger, usually in contact, completely covering the area.
7. Pectoral nearly truncate, the thickened lower rays 5 in number, the longest of these little produced beyond general margin of fin.
8. Vertical fins more posteriorly inserted, the length anterior to the spinous dorsal one-third the total to base of caudal.
9. Caudal posteriorly rounded.

X. leiops.

1. A series of oblong black blotches on sides.
2. Black margin of dorsal widened anteriorly to include greater part of first interspinous membrane.
3. 18 or 19 plates behind dorsals.
4. No spinelets on eye.
5. Median pairs of postanal plates little developed, hidden beneath the integument.
6. Plates on breast weaker and smaller, the anterior at least widely separated.
7. Pectoral deeply notched, the thickened lower rays 4 in number, the longest of these much produced.
8. Vertical fins more anteriorly placed, the predorsal length two-sevenths the total to base of caudal.
9. Caudal posteriorly truncate when spread.

XENERETMUS RITTERI, new species.

Plate 17, fig. 11.

Type-specimen.—Cat. No. 75814, U.S.N.M., 137 mm. long, from station 4366, near San Diego, depth 176 to 181 fathoms.

Most nearly allied, perhaps, to *X. latifrons*, but differing from the latter in the coloration, the increased number of rays in the pectoral fins, the presence of two maxillary barbels instead of one, and in the much stronger ridges and spines everywhere on head and body. Branchiostegal membranes with an extremely narrow free-fold posteriorly.

Dorsal, VII, 7; anal, 7; pectoral, 16; lateral line, 41.

Shape similar to *X. latifrons*, but more robust, both width and depth of body greater than in that species. Head short and broad, the snout even wider and more bluntly trigular than in *latifrons*, when seen from above. Interorbital space a shallow groove, somewhat wider than in *latifrons*. A deep transverse groove behind the nasal spines, one behind the eyes and one behind the occiput. Terminal rostral plate with a single curved upright spine smaller than the nasal spines; supraocular and two occipital pairs of spines, as usual. Subocular ridge higher than in related species and bearing stronger spines, two on the posterior part of the cheek and two on the preopercle. No spines on margin of preopercle below the ridge. Cheeks below the suborbital ridge naked, without plates or prickles.

Opercular ridge much more conspicuous than in *latifrons*. Margin of preorbital entire.

Mouth wide, maxillary extending scarcely beyond the front of the orbit. Teeth in wide villiform patches in jaws and on vomer and palatines, the vomerine patch emarginate posteriorly. Two barbels constantly present on the end of the maxillary, the anterior the shorter. Four barbels arise from the margin of pores near mandibular symphysis. Branchiostegal membrane with an extremely narrow free-fold posteriorly, where it crosses the throat. Eye contained slightly more than three times in the length of the side of the head; on the eyeball above the pupil a series of 5 to 7 strong spinelets, hooked obliquely backwards and inwards toward median line.

Body with the ridges higher, the spines stronger, and the intervening faces more deeply concave than in *latifrons*, the arrangement otherwise similar. Four pairs of strong postanal plates present in the type, and 24 heavy plates on the breast. The ventral series of plates bear spines posteriorly as far as the front of the anal fin, all other series being strongly spinous throughout. No plates are present on the gular or branchiostegal membranes.

First dorsal spine inserted on the seventh, the last spine on the thirteenth plate of the dorsal series; first ray of second dorsal on the seventeenth, the last ray on the twenty-second plate. Anal fin inserted opposite the second dorsal. There are 16 plates (sometimes 15) behind the last dorsal ray. Pectoral wider than in related species, with 16 rays, the lower 6 or 7 thickened, with exserted tips. The fin is evenly truncate when spread, the lower rays scarcely protruding beyond the general margin of the fin; the membrane not incised between the upper unmodified and the lower thickened rays. Caudal rounded; ventrals reaching slightly more than one third the distance to front of anal fin, the anus immediately behind their base in adults, more posteriorly placed in the young.

Color olive-brown, darker than in related species, this strongly marked on the under side of the tail, where the dark area extends well forward of the anal fin. Breast, abdomen, and lower side of head white, as is also much of the postaxillary region. About 8 indistinct narrow dark crossbars on the back, better marked on the spines than on the intervening areas of the plates. A black blotch on the shoulder extending to the upper part of the axil. Pectoral translucent or whitish, a dark blotch occupying the base of the upper rays, and a wide dark bar on the distal half of the fin involving the rays only and not reaching their tips. Spinous dorsal with a broad black bar at base and a black margin, the rest of the fin whitish. Soft dorsal similar, but the basal black bar and the succeeding white bar narrow, the marginal black area involving more than half the fin. Caudal black, with a narrow white edge and an oblique whitish bar near base of upper half of fin. Ventrals and anal white.

Measurements in hundredths of length to base of caudal:

Length of head.....	24.5
Length of snout.....	6.5
Diameter of orbit.....	7.5
Interorbital width.....	2.7
Width of head.....	15
Depth at occiput.....	11.5
Distance from tip of snout to end of maxillary.....	7.5
Width of mouth.....	7.5
Greatest depth of body.....	13
Length of caudal peduncle.....	40
Distance from tip of snout to front of dorsal.....	32.5
Distance from tip of snout to second dorsal.....	49.5
Distance from tip of snout to anal.....	49
Length of second pectoral ray.....	16.5
Length of ninth pectoral ray.....	14
Length of twelfth pectoral ray.....	17
Length of sixteenth pectoral ray.....	6
Length of ventral fin.....	9
Length of caudal fin.....	13
Length of first ray of second dorsal.....	12.5
Total length to base of caudal, in millimeters.....	122

Four paratypes were obtained from the same station and one from station 4322, near San Diego, depth 227 to 193 fathoms. These specimens vary as follows: Dorsal, V to VII, 6 to 7; anal, 6 to 7; pectoral, 16 (17 on one side of one specimen), 6 or 7 of the lower rays thickened and exserted.

The species is named in honor of Dr. W. E. Ritter, director of the Scripps Institution for Biological Research.

XENERETMUS TRIACANTHUS (Gilbert).

In addition to the characters given in the preceding key to species the following may be presented: Prepectoral region, except that part opposite the upper two pectoral rays, covered with large plates, those in *latifrons* thinner and concealed. Breast wholly covered, the plates all overlapping. The normal arrangement of the breastplates is the following: The median series consists of two pairs in front of ventrals, with a minute plate lying posteriorly between the bases of the two ventral fins; in front of the paired plates are three median unpaired. At the side of the median series 4 plates form an anterior continuation of the ventro-lateral series, each plate with a slightly raised center. Between these and the series at base of pectoral fin is an irregular series of 4 crowded plates. There are also 4 at the base of the pectoral fin, the uppermost concealed beneath the integument. The minute plate between bases of ventral fins does not become enlarged and interpose between the plates of the posterior pair, as sometimes in *latifrons*. The commonest irregularity is in the coalescence of the anterior pair of median plates, or in the division of the median

plate which lies in front of the anterior pair. In different specimens, therefore, the number of paired median plates may vary from one to three.

There are three pairs of well-developed mental barbels.
Vomerine patch of teeth subcircular, the posterior margin indented. Palatine bands about as wide as those in jaws.

Small round spots (bright blue in life, surrounded by narrow dusky rings) are invariably present, though varying greatly in number. The most conspicuous spot occupies the depression on median line behind the supraocular spines. A smaller spot is usually present between the eyes, one on upper part of opercle, and one on median line of back between first and second pairs of dorsal plates. Other spots are less constant in position.

In 22 specimens the fin rays are as follows:

	Dorsal spines.		Dorsal rays.		Anal rays.	
	V	VI	6	7	6	7
Specimens.....	1	21	7	15	19	3

The pectoral rays are always 13 (9 + 4) in number. Median plates on caudal peduncle 16 or 17 in number.

List of stations.

		<i>Fathoms.</i>
4305	Off San Diego.....	67-116
4310	.....do.....	71- 75
4322	.....do.....	110-199
4343	.....do.....	55-155
4347	.....do.....	55- 58
4384	.....do.....	85-164
4385	.....do.....	80- 89
4453	Monterey Bay.....	49- 53
4457	.....do.....	40- 46
4460	.....do.....	55-167
4472	.....do.....	59- 71
4473	.....do.....	54- 65
4482	.....do.....	43- 44
4518	.....do.....	66-140
4554	.....do.....	60- 80

ODONTOPYXIS TRISPINOSUS (Lockington).

Taken at the following stations:

		<i>Fathoms.</i>
4309	Off San Diego.....	67-78
4452	Monterey Bay.....	49-50
4453	.....do.....	49-51
4454	.....do.....	65-71
4176	.....do.....	25-39
4477	.....do.....	11-19
4487	.....do.....	18-19
4489	.....do.....	18-20
4519	.....do.....	27-35
4550	.....do.....	50-57
4552	.....do.....	66-73
4562	.....do.....	10-11

CAREPROCTUS MELANURUS Gilbert.

A single specimen taken at station 4307, off San Diego, depth 169-496 fathoms.

PARALIPARIS CEPHALUS Gilbert.

4317	Off San Diego.....	<i>Fathoms.</i> 161-510
4334	.....do.....	514-541
4380	Off North Coronado Island.....	530-618

No trace of a membrane narrowing the wide gill-opening, which in all the specimens collected appears to extend from above the pectoral to a point entirely below the pectoral fin. The condition reported in one of the cotypes, which is said to have had the gill-opening restricted to the area above base of pectorals, has not been verified in any of the numerous specimens subsequently examined and must be considered questionable. Through an error in the original description, repeated by Jordan and Evermann,¹ the maxillary is said to be "slightly more than length of head." This should read slightly more than half length of head.

PARALIPARIS ULOCHIR Gilbert.

Two small specimens from stations as follows:

4516	Monterey Bay.....	<i>Fathoms.</i> 718-756
4538	.....do.....	795-871

The integument is largely lost, so the original color of these young specimens can not be given. The head is dusky and the abdomen lined with black.

PARALIPARIS MENTO Gilbert.

Plate 18, fig. 12.

One specimen, 75 mm. in total length, from station 4512, Monterey Bay, 309 to 536 fathoms.

Agreeing with the description of the type in the salient characters of this very striking species, but differing in certain details of measurement.

Length to base of caudal, 65 mm. Length of head, twenty hundredths of total length without caudal; greatest depth, at occiput, 22; greatest width of head, 12.5; diameter of eye, 5.5; length of snout, 6; interorbital width, 8.5; length of maxillary, measured from tip of snout, 9; width of gill-slit, 7.5; length of longest upper pectoral ray, 24; of longest ray of lower lobe, 25; of shortest ray in notch, 5. The chin is broad, rounded, and prominent, slightly protuding beyond the profile, but the mandibular margin shuts within the premaxillaries.

¹ Fishes of North America, p. 2141.

The pectoral is very low and with nearly horizontal base. The gill-opening is rather wide, but is entirely confined to the suprapectoral region.

Dorsal, 58; anal, 53; pectoral, 16.

The original description credits the type-specimen with having but 43 rays in the anal fin, but this is obviously a misprint for 53, as the dorsal and anal seem to differ in number by about 5 rays throughout this relationship.

PARALIPARIS DEANI Burke.

~ *Paraliparis deani* BURKE, Proc. U. S. Nat. Mus., vol. 43, 1913, p. 571; southeast Alaska.

A single specimen, 92 mm. long to base of caudal, from station 4540, Monterey Bay, depth 389 to 551 fathoms, probably belongs to this species. It agrees in most respects, but has a somewhat smaller eye and greater depth. The presence of prickles on the pectoral fins can not be verified.

The occiput is arched, somewhat as in *P. cephalus*, with broad interorbital area and wide blunt snout; the mouth is horizontal, the maxillary extending to below posterior fourth of orbit. Gill-opening wide, extending along the upper half of the pectoral fin. Upper ray of pectoral on a level with middle of orbit. Pectoral without deep notch, the lower three or four rays forming a lengthened lobe, the longest ray reaching beyond the front of the anal; the rays immediately above this lobe are more widely separated than those in the upper part of fin.

Length of head, twenty-two hundredths of total length without caudal; greatest width of head, 13; greatest depth at occiput, 19; width of mouth from angle to angle, 10; distance from tip of snout to end of maxillary, 11.5; to base of lowest pectoral ray, 13; to vent, 15.5; length of snout, 7; diameter of eye, 5; interorbital width, 14.

Dorsal, 59; anal, 49; pectoral, 16. General color light, the abdomen and eye blackish.

PARALIPARIS ALBESCENS, new species.

Plate 18, fig. 13.

Type-specimen.—Cat. No. 75816, U.S.N.M., a female with well-developed ova, 63 mm. long, from station 4515, Monterey Bay, 198 to 495 fathoms.

Not closely related to any other species, the head, body, and fins uniformly translucent or whitish, the gill-slit wide, extending to opposite tenth or eleventh pectoral ray, the upper ray of pectoral fin on level of middle of eye, the fin many-rayed, short, moderately notched, the rays of lower lobe all widely exerted, the longest equaling those of the upper lobe.

Length of head twenty-four one-hundredths of total length without caudal; width of head behind orbits, 15.5; depth at occiput, 21;

diameter of eye, 6; length of snout, 6; axial length of snout, 4; length of maxillary (from middle of premaxillaries), 8.5; width of mouth between the outer angles, 13.5; length of gill-slit, 9.8; distance from tip of snout to vent, 20; to lowest pectoral ray, 15.5; distance between lowest pectoral rays of the two sides, 5; distance from tip of snout to front of anal, 33; to front of dorsal, 24; length of pectoral base, 12.5; longest ray of upper lobe, 14.5; longest ray of lower lobe, 17. Dorsal, 3+46; anal, 44; pectoral, 18.

Head short and broad, with large eyes and very short snout, the latter protruding slightly beyond the mouth; mouth horizontal, the maxillary reaching to below middle of eye. Teeth acute, simple. Nostril single, without tube. Gill-opening extending down to opposite the tenth or eleventh pectoral ray. Pectoral inserted high, the upper ray on level of middle of eye, the lower ray in a vertical line which falls behind the orbit; the two fins well separated below. All the rays of lower lobe are widely exserted; none extend beyond front of anal. The lobes are short, and are connected a rather deep notch, with two or three widely spaced rays. Anus below the middle of the opercle.

Dorsal beginning above the upper end of gill-slit, the first three rays exceedingly delicate and spine-like, apparently separated from the others by a short interval of membrane which contains no rays. The caudal contains four fully developed rays, its basal third joined to dorsal and anal.

Color translucent or whitish throughout, the sides with minute distant black specks, visible only with aid of a lens. Mouth gill cavity and peritoneum without black pigment.

Only the type known.

PARALIPARIS CAUDATUS, new species.

Plate 18, fig. 14.

Type-specimen.—Cat. No. 75815, U.S.N.M., 86 mm. in total length (77 mm. to base of caudal). from station 4527, Monterey Bay, 183 to 337 fathoms.

Resembling *P. ulochir* in the restricted gill-slit and the wide pectoral, but differing among other characters in the shorter, deeper body, and the wider, many-rayed caudal fin. In *P. ulochir*, the trunk tapers to an extremely slender tail, the fin composed of but 4 rays. In *P. caudatus*, the base of the caudal has an easily appreciable width and the fin contains 10 or 11 rays.

Length of head thirty one-hundredths of total length to base of caudal; greatest width of head, 17; greatest depth (at nape), 26; length of snout, 9; diameter of eye, 5; interorbital width, 12; length of maxillary, 13; width at outer angles of mouth, 15; width of gill-

slit, 5.5; distance from tip of snout to anus, 21; to base of first dorsal ray, 30; length of caudal, 13; width of pectoral base, 18; longest ray of upper pectoral lobe, 14; of lower pectoral lobe, 28; of shortest rays in notch, 5.

Dorsal, 53; anal, 50; pectoral, 28.

Dorsal profile strongly arched at occiput and nape, the origin of dorsal but little behind the apex of the arch. Profile of head strongly declivous, that of snout nearly vertical; interorbital region transversely wide and flat; mouth horizontal, at lower profile, the snout protruding a trifle beyond the premaxillaries; maxillaries extending to below posterior margin of pupil; majority of the teeth in both jaws rather short triangular, with a distinct pair of lateral cusps, a few of the teeth at the margin of the band simple. Gill-slit short, confined to suprapectoral area, covered by a long tongue-shaped opercular flap; nostril single, with slightly raised margin; pores on head rather small. Vent well forward, under the posterior margin of cheek.

Origin of dorsal vertically above anterior part of gill-slit; basal fourth of caudal fin attached to dorsal and anal. Upper pectoral ray on level of middle of eye, the lower rays of the two fins closely approximated under the posterior portion of the eye. Upper pectoral lobe short, wide, and bluntly rounded, scarcely reaching vertical from front of orbit. The three lower rays are short and largely free, the four above it forming a very long narrow lobe, with only the tips free, extending beyond the front of the anal. Above these, the fin is abruptly and deeply notched; the rays in the notch very delicate, but little more widely spaced than the rays above.

Peritoneum and lining of gill-cavity black, showing through the integuments. Caudal fin and the neighboring parts of dorsal and anal dusky. Eye dark. Head and body otherwise light in color, perhaps reddish in life.

Only the type known.

RHINOLIPARIS ATTENUATUS Burke.

Three specimens of this species were taken at the following stations:

4515	Monterey Bay.....	<i>Fathoms.</i> 198-495
4540	.....do.....	389-551
4541	.....do.....	381-633

There seem to be typically 7 rostral filaments, 3 in an upper series, with the unpaired filament on the median line, and 4 in a lower series of 2 pairs. In 1 specimen, the pyloric cæca are 7 in number. The pectoral rays are 21. Branchiostegals 6.

LIPARISCUS, new genus (*Liparididae*).

Allied to *Paraliparis* and *Nectoliparis*, agreeing in habit with the former, and with the latter in having but 5 branchiostegal rays, while all other genera and species in this group have 6.

No trace of a ventral disk. Vent posterior in position, lying in the area between the lower pectoral lobes. Pectoral fin greatly reduced, but the two lobes connected, not separate and distinct as in *Nectoliparis*. Teeth simple, in narrow bands. Branchiostegals 5. Gill-slit narrow, confined to the suprapectoral region.

Type of the genus.—*Lipariscus nanus*, new species.

LIPARISCUS NANUS, new species.

Plate 19, fig. 15.

Type-specimen.—Cat. No. 75817, U.S.N.M., 47 mm. long, from station 4461, Monterey Bay, 285 to 357 fathoms.

Length of head twenty hundredths of total length to base of caudal; length of snout, 5; width of interorbital, 8; diameter of eye, 6; width of head, 13; length of maxillary, 8; length of gill-slit 2.5; pectoral greatly reduced, enveloped in a thick membrane, its upper ray on a level with lower margin of pupil. The lower lobe consists of only 2 rays closely apposed and but slightly lengthened. The total number of pectoral rays is 12 or 13, the upper lobe also short, the intermediate rays in the notch 2 or 3 in number, more widely spaced than the other rays. Lower pectoral rays separated by a wide interval.

Body deepest at front of dorsal, the occiput not gibbous. Interorbital space narrow, equaling the diameter of the eye. Snout short, very bluntly rounded, the mouth inferior, horizontal, the maxillary reaching a vertical from hinder edge of pupil. Nostril without tube.

Caudal narrow, with 4 rays, its basal fourth joined to dorsal and anal. Gill-slit very short, confined to area above base of pectoral; a narrow triangular opercular flap. Vent posterior in position, under the middle of the base of the pectoral. Snout and sides of body dusky; lining membranes of mouth, gill cavity and abdominal cavity jet black, the opercular region and the abdomen thus appearing black.

One paratype from the type-locality, and three others from station 4468, Monterey Bay, 32 to 309 fathoms.

NECTOLIPARIS PELAGICUS Gilbert and Burke.

A very widely distributed deep-pelagic form, extending from the coast of southern California throughout the Bering Sea and south to the shores of Hokkaido, Japan. It has been frequently captured in Bering Sea in open intermediate nets dragged at 300 fathoms. In the present collection, several specimens are included, which apparently entered the open trawl on its way to the surface.

List of stations.

		<i>Fathoms.</i>
4333	Off San Diego.....	301-487
4423	Off San Nicolas Island.....	581-594
4539	Monterey Bay.....	465-609
4541	.....do.....	381-633

RHINOGOBIUS NICHOLSI (Bean).

Abundant in the harbor at Avalon, Catalina Island. Has also been taken in shallow water, but not between tides, at Monterey.

RATHBUNELLA HYPOPLECTA (Gilbert).

A young specimen 29 mm. in extreme length, was taken by the "tangles" on rough bottom near Santa Rosa Island (station 4431), in the Santa Barbara Channel, at a depth of 38 to 41 fathoms. On account of its small size, it is not possible to verify the characters alleged to distinguish this species and the very closely allied *R. allenii*. The scales are not yet fully developed, but leave the top and sides of head, the nape, and a strip along base of dorsal fin naked. The depth is one-seventh the length to base of caudal. The first five dorsal rays are shorter than the succeeding and appear slightly differentiated.

The color pattern is sharply defined on a light background. Along median line of sides, runs a narrow brown streak, marked below by about 10 V-shaped prolongations, and above by an equal number which alternate with the first. The basal half of the dorsal fin is marked by 14 or 15 small dark brown spots, evenly spaced. Anal with a narrow submarginal black streak edged with white. Pectorals, ventrals, and anal unmarked. Dorsal, 46; anal, 32.

PLECTOBRANCHUS EVIDES Gilbert.

Several specimens, from the following stations:

		<i>Fathoms.</i>
4322	Near San Diego.....	110-199
4365	.....do.....	130-153
4367	.....do.....	201
4475	Monterey Bay.....	58-85

Only the type was heretofore known, taken on the coast of Oregon at a depth of 46 fathoms.

The two canines in the front of the jaw, strikingly developed in the type, are little evident in the majority of these specimens. The nostril is provided with a very thin walled tube, which greatly resembles a simple flap when collapsed, and was so described in the type. As in *Poroclinus hemphilli*, there are no pores along the course of the lateral line, but a series of imperforate papillæ mark its course. A series of similar papillæ, more closely crowded, on the suborbital area.

CRYPTOTREMA CORALLINUM Gilbert.

One specimen, 134 mm. long, from station 4420, near San Nicolas Island, depth 32 or 33 fathoms.

The teeth have been inadequately described in the species. In the front of each jaw is a close-set series of strong conical teeth, the series continued on the lateral margins of the jaws and the teeth there greatly decreasing in size. Behind the outer series is a rather broad patch of short villiform teeth, which are confined to the anterior part of the jaw, the patch in the mandible smaller than that in the maxillary. A single more or less irregular series of small conical teeth on the vomer and the contiguous part of the palatines, the latter with only two or three of the teeth on its extreme anterior portion.

In the specimen before us the diameter of the eye is slightly less than the length of the snout, and is contained $4\frac{1}{3}$ to $4\frac{1}{2}$ times in the length of the head. The longest pectoral rays are below the middle of the fin, but the lowermost rays are progressively shortened. The black blotches on sides are formed as local intensifications of brownish bars which descend from the back. Each of the blotches is forked indistinctly, forming an inverted V.

EMBRYX PARALLELUS, new species.

Plate 19, fig. 16.

Type-specimen.—Cat. No. 75818, U.S.N.M., 387 mm. long, from station 4514, Monterey Bay, depth 394 to 406 fathoms.

Closely related to *E. crassilabris*, characterized by the parallel, nearly vertical sides of head, the thickened lips, the uniserial premaxillary teeth, and the dark coloration. From *crassilabris* it differs principally in the much broader head, and the more extensive scaling of the sides of the head. In *crassilabris* the greatest width of head is a trifle more than one-third the length of the head; in *parallelus* it is one-half that length.

Body very slender, the depth 14.3 times in the total length. Head with nearly vertical parallel sides, of nearly uniform width to the base of the snout, the outline of which is broadly rounded, seen from above. Lips and adjacent tissues soft and fleshy. Lower jaw included, shutting wholly inside the premaxillary teeth. Maxillary reaching vertical from middle of eye. Eye less than length of snout, 5.8 times in length of head. Premaxillary teeth cardiform, close set, in a single series, the teeth diminishing slightly laterally, the series short, extending but little more than half distance to angle of mouth. Mandibular teeth anteriorly in a broad band, the anterior and posterior series obviously enlarged, the band abruptly constricted at the middle of the side of the jaw and continued a short distance

laterally as a single series. Vomer and palatines toothless. Series of large pores along sides of snout and on mandibles, all other pores on head moderate or small; two of these conspicuously placed in the same vertical behind the orbit, one on the preopercular margin above its middle, and another nearly vertically above it at side of occiput. Opercular membrane forming a wide flap which overlaps the basal portion of upper pectoral rays. Lower end of gill slit scarcely below base of pectoral, opposite the middle of the rather long ventral fins.

Posterior line of occiput midway between the front of dorsal and front of eye. Axil of lower pectoral ray midway between the tip of the snout and the vent. Pectorals reaching half way from their base to the front of the anal fin; posterior margin of pectorals broadly rounded, the rays all branched, the lower rays with thickened membrane and exserted tips.

Vertical fins scaled nearly to their tips; pectorals with about half of the posterior face and the basal third of the anterior face scaled. Occiput covered with reduced scales nearly as far forward as the eyes; opercles, subopercles, the upper branchiostegal ray, and the greater portion of the cheeks and preopercles covered with densely crowded very small scales.

Lateral line running from shoulder obliquely downward to slightly below middle of body, traceable backward to within a head's length of the tail, having regained middle of body at this point.

Color dark-brownish or purplish, the lower side of head and the fins darker. Lining of mouth, gill cavity, and body cavity black.

Measurements in hundredths of total length:

	<i>Paral-</i> <i>lelus.</i>	<i>Crassi-</i> <i>labris.</i>
Length of head.....	15	14.2
Length of snout.....	3.9	3.6
Diameter of eye.....	2.6	3.2
Greatest width of snout.....	6.6	4.8
Greatest width at cheeks.....	7.5	5
Greatest width at opercles.....	7.5	4.8
Length of maxillary.....	5.5	4.8
Length of mandible.....	6.5	6.5
Distance from tip of snout to posterior line of occiput.....	9.5	9.7
Distance from posterior line of occiput to front of dorsal.....	7.5	7.8
Distance from tip of snout to vent.....	28	28.5
Length of pectorals.....	8.3	7.3
Length of ventrals.....	2	1.5
Depth of body.....	7	6
Total length in millimeters.....	387	303

Only the type known.

APRODON CORTEZIANA Gilbert.

4423. Off San Nicolas Island, 216 to 339 fathoms.

FURCIMANUS DIAPTERUS (Gilbert).

Males are much less abundant than females and are recognizable externally by the much larger mouth and the stronger teeth, the maxillary extending to a vertical which traverses the middle of the orbit, while in females a vertical line from the tip of the maxillary passes through the front of the pupil, or a trifle behind that point.

List of stations.

		<i>Fathoms.</i>
4323	Off San Diego.....	193-227
4325	.....do.....	191-292
4326	.....do.....	243-280
4369	.....do.....	260-284
4509	Off Monterey Bay.....	152-286
4510	.....do.....	91-184

LYCONEMA BARBATUM Gilbert.

A single specimen at station 4358, off San Diego, depth 167 to 191 fathoms.

Measurements in hundredths of total:

	<i>mm.</i>
Total length, including caudal.....	121
Length of head.....	18.5
Length of snout.....	4.6
Diameter of eye.....	6
Greatest depth.....	9.5
Distance from snout to front of anal.....	34
Distance from snout to front of dorsal.....	21
Length of pectoral.....	9.5
Length of ventral.....	2.5

So far as known, this species is confined to southern California. The statement by Jordan and Evermann¹ that it inhabits the coast of Alaska is without warrant.

MAYNEA CALIFORNICA, new species.

Plate 19, fig. 17.

Type-specimen.—Cat. No. 75819, U.S.N.M., 140 mm. long, from station 4421, off San Nicolas Island, 229 to 298 fathoms.

Dorsal 110, anal 93, both counted to middle of caudal fin; pectoral, 12.

Length of head, fifteen hundredths of total length; length of snout, 3.5; diameter of eye, 2.3; interocular width, 2; maxillary length, 5; greatest width of head, 6; length of gill-slit, 5; greatest depth of body, 9; predorsal length, 18; length before anal fin, 36; width of pectoral base, 3; length of pectoral, 8.

Body slender, moderately compressed, deepest at abdomen; occipital region approximately quadrangular in cross section, the upper sur-

¹ Bull. 47, U. S. National Museum, pt. 3, 1898, p. 2475.

face nearly flat, the cheeks vertical; snout broader than long, little declivous, depressed, subacute; nostril tube single, short, immediately behind the upper lip; mouth moderately oblique, distance between angles of mouth equal to length of gape; tip of maxillary extending nearly to below middle of eye; jaws about equal, the lower scarcely included within the upper; upper jaw not protractile, the lower lip with a frenum; no barbels; teeth all short, conical, strong; premaxillary teeth anteriorly in two well-separated series, those of the anterior series larger, the posterior series alone continued laterally, but not reaching much beyond middle of gape; mandibular teeth somewhat larger, in a double series anteriorly, with a few irregularly interposed teeth near symphysis, the posterior series continued farther laterally than the anterior series; strong conical teeth in a single series on palatines, these larger than the teeth in the jaws; a single series on head of vomer, with a few scattered teeth behind it. Skull firm, no large mucous channels or pits in any of the bones; a series of large pores around the eye, one along mandible and preopercle, and a series curved forward from shoulders across occiput. Gill-openings narrower than in *Bothrocara*, the distance between their lower ends equaling the length of the snout, less than two-thirds the length of the gill-slit, which begins above the base of the pectoral and extends well below it. Gill-fringes ample, in 4 pairs, a wide slit behind the fourth arch; gill-rakers reduced to little more than papillæ, 13 in number on outer arch. Pseudobranchiæ obsolete. A single short, thick pyloric cæcum.

Origin of dorsal fin over middle of pectoral, the fin lower anteriorly. Dorsal and anal rays slender, once forked near the base, the posterior branch again forked at its middle, the anterior branch simple throughout; caudal rays only once forked. Pectorals with broad base, the posterior margin evenly rounded, the length slightly more than half head, more than one-third the distance from its base to origin of anal; pectoral rays twice or thrice forked.

Scales small, rounded, nonimbricated and rather distant, covering sides of body and basal portions of vertical fins; the pectoral fins and the distal portions of vertical fins, the nape and the entire head scaleless; scales on breast and belly much reduced, smaller and partially absorbed. No trace of lateral line. Skin on head and body not lax, the texture like that in *Lycodes*; fin membranes not thickened, except at base.

In spirits brownish yellow, darker along the back, a broad margin of the vertical fins and the entire pectorals translucent. Buccal and branchial cavities whitish, peritoneum slightly dusky. In life, the entire fish is tinged with light rose-red.

Type 140 mm. long, from station 4421, off San Nicolas Island, depth 229 to 298 fathoms. Only the type known.

Apparently closely allied to *Maynea patagonica*, but less robust, with sharper more tapering snout, more posterior insertion of dorsal fin, longer pectoral fin and wider gill-slits. In *M. patagonica*, the dorsal fin has its origin in advance of the base of the pectoral; the pectoral fin is short, less than one-third the distance between pectoral base and origin of anal fin; and the gill-slit extends only to a point just below the middle of the pectoral base.¹ *M. patagonica* also is said to have developed pseudobranchiae.

Maynea bulbiceps Garman is apparently without pores on sides of head. The figure of the type represents the fin rays as simple, but in a note kindly communicated to me by Mr. Garman, I am informed that they are not simple, the median pectoral rays being thrice divided. *Gymnelis conorhynchus* Garman should apparently be referred to *Maynea* rather than to *Gymnelis*, the latter being characterized by the entire absence of scales. *M. conorhynchus* seems to have no pores on head, the dorsal and anal fins have less numerous rays, while the rays of the pectoral are more numerous than in *M. californica*; also, the suborbital ridge is swollen and prominent, making the mouth appear inferior. In other respects it appears closely related to *M. californica*.

LYCOGRAMMA, new genus (*Zoarcidae*).

A deep-sea Lycodid, without ventral fins, with wide gill-slits continued well forward under the throat, the two narrowly separated anteriorly; the bones of head deeply channeled for sensory canals; the body scaled; the lateral lines distinct, two in number, the anterior running high on sides, parallel with the back, discontinued at a point about one orbital diameter behind the vent; the posterior line beginning below and slightly in advance of this point and running along middle of sides to the tail.

Type of the genus.—*Maynea brunnea* Bean.

LYCOGRAMMA BRUNNEA (Bean).

Plate 20, fig. 18.

The following description is based on a specimen 271 mm. in total length from station 4380:

Dorsal, 107 (without caudal); anal, 92; pectoral, 17 on each side; upper lateral line with 25 pores.

Length of head, 24.5 hundredths of total length; diameter of eye, 5.3; interorbital width, 4.5 (bony interorbital width, 3.5); length of snout, 7.5; length of maxillary, 10; greatest postocular width of head, 10; distance between front ends of gill-slits, 1.3; distance from snout to front ends of gill-slits, 14; greatest depth of body, 15;

¹ See Proc. Zool. Soc. London, 1881, pl. 2, figs. C and D.

distance from tip of snout to base of first dorsal ray, 26.6; distance from tip of snout to vent, 40; length of longest dorsal rays, 7.2; longest anal ray, 5; length of pectoral. 12.

Body compressed, sides of head vertical, greatest depth at front of dorsal; profile of head declines in a straight line from occiput to snout, the profile of the latter rendered concave on account of its protruding terminal portion; end of snout vertical. In fresh specimens the eyes completely fill the sockets and the mucous pits are not conspicuous. Mandible included, shutting within the outer series of premaxillary teeth. Mouth oblique, the vertical from end of maxillary crossing eye behind its middle. Mandibular teeth in a broad band anteriorly, the outer series scarcely enlarged, the band rapidly tapering laterally to an irregular single series or a narrow band; premaxillary teeth consisting of an outer series, usually more or less enlarged anteriorly, and an inner series of shorter slenderer teeth directed downwards and backwards. The two series are widely separated anteriorly, but converge laterally, and both usually reach the angle of the mouth. Both anteriorly and posteriorly, small teeth may occur in greater or less numbers between the two rows, thus producing a broad band in front of jaw, and a narrow band at the side. Vomerine teeth in a single series or a short narrow transverse band of not more than two irregular rows. Palatine teeth in a single series, which is irregular or sometimes even two ranked, the series long, extending from near vomer to opposite angle of mouth; both vomerine and palatine teeth well developed throughout, in young as well as in adults, as strong as the premaxillary teeth.

A single short nostril tube. Gill-slits continued well forward under throat, separated by a narrow isthmus, which is behind the vertical from posterior margin of orbit a distance but little less than the ocular diameter. Branchiostegals 6. Pseudobranchiæ well developed, consisting of about 10 filaments. Gill-rakers short and broad, movable, abruptly curved below the enlarged spinous tip, 3+15 in number.

Body completely and rather closely scaled; scales on breast, belly, and nape much reduced in size; head naked; anterior portions of dorsal and anal fins enveloped in thick gelatinous tissue, and scaled almost to their margins; posteriorly the naked margin widens rapidly, until it embraces the entire height of the fins; pectorals scaled only on extreme base.

A narrow line of minute close set pores from near upper rim of orbit to posterior line of occiput, the line curved, with the convexity outward. Upper lateral line beginning at shoulder, rising gently and continued parallel with back to a short distance behind vent, containing 25 to 28 pores; lower lateral line beginning on middle of sides immediately in front of end of upper line, continued to base of tail, though frequently indistinct posteriorly.

Dorsal fin beginning immediately behind head, the posterior line of occiput midway between front of eye and base of first dorsal ray. Origin of anal under eighteenth dorsal ray. Pectoral broad, variable in length, but not nearly reaching vent. Rays of all the fins forked for a short distance near tips.

Color in spirits brownish or grayish brown, in life translucent olive, the dorsal and anal anteriorly narrowly margined with dusky, the marginal dusky streak widening and intensifying posteriorly until it includes the entire fin, and is jet black with a very narrow white edge. Mouth light, gullet and gill cavity brownish or black, the gill membranes with a broad sharply contrasting white edge. Gill arches not black. Peritoneum black; a black ring around vent.

List of stations.

		<i>Fathoms.</i>
4317	Off San Diego.....	161-510
4333	.....do.....	301-487
4351	.....do.....	423-488
4380	Off Coronado Islands.....	530-618
4403	Off San Clemente Island.....	505-599
4405	.....do.....	654-704
4407	Off Santa Catalina Island.....	478-600
4516	Monterey Bay.....	718-756
4540	.....do.....	389-551

BOTHROCARA REMIGERA, new species.

Plate 20, fig. 19.

Type-specimen.—Cat. No. 75820, U.S.N.M., a male, 283 mm. long, from station 4516, Monterey Bay, depth 718 to 756 fathoms.

Dorsal, 112 (without caudal); anal, 94; pectoral, 15 on each side.

Length of head, twenty-one one-hundredths of total length; horizontal diameter of eye, 4.6; width of frontal bone between orbits, 2.5; distance from tip of snout to front of eye, 6.1; length of maxillary, 8; greatest postocular width of head, 8.5; distance from tip of snout to front end of gill-slits, 12.5; greatest depth of body, 12; distance from tip of snout to base of first dorsal ray, 22; to vent, 35; from vent to base of pectoral, 16; longest pectoral ray, 17.5.

Occiput broad, with a median lengthwise keel. Interorbital region narrow, the median sensory pit longer and narrower than in *Lycogramma brunnea*, the pair behind it strongly diverging, while in *brunnea* they are nearly parallel. Tip of snout prominent above, the profile behind the tip concave.

Mouth horizontal, the mandible included, the tip of maxillary reaching a vertical from middle of eye. Premaxillary bands of teeth narrow laterally, widening in front, the outer series slightly enlarged, the inner series directed backwards and downwards; mandibular teeth uniform, small, anteriorly in a wide band which tapers laterally to a single series. Vomer with a short median patch on its

anterior end; palatine bone with a short series anteriorly, which may be irregular, almost two ranked, the length of the series about that of the premaxillary band in the type, much shorter than in *L. brunnea*. Gill-slits very narrowly separated below, almost reaching vertical from posterior margin of orbit. Branchiostegals, 6. Pseudobranchiæ well developed. Gill rakers slender, not long, with slender tip not decurved, 4 + 15 in number.

Head naked; body completely scaled, except possibly the extreme anterior border of nape; the scales diminish in size on anterior part of trunk, and become greatly reduced on nape, prepectoral area, belly, and breast. Vertical fins scaled almost to their tips anteriorly, the scaly area narrowing rapidly posteriorly. Pectorals scaled at base only. Lateral line single, pursuing a wavy course from shoulder obliquely upwards and backwards to near base of dorsal fin, along which it runs to near middle of length. A curved line of minute pores on occiput behind eye.

First dorsal ray inserted above opercular margin, the posterior line of occiput midway between first dorsal ray and front of eye. Origin of anal under sixteenth dorsal ray. Pectoral narrow, elongate, but shorter than head, the rays exserted at tips. All the fin rays are simple, not forked at tip. The pectoral rays vary from 13 to 16 in number, thus in 5 specimens: $\frac{13}{13}, \frac{13}{14}, \frac{14}{14}, \frac{15}{15}, \frac{16}{16}$.

In spirits, light brownish, vertical fins margined with dusky anteriorly, becoming completely black posteriorly; pectorals whitish or dusky. Entire lining of mouth and gill cavity jet black, the gill arches also blackish; no conspicuous whitish margin to gill membranes. Peritoneum black.

Closely related to *B. alalonga* Garman, from the Gulf of California, but with larger eye, longer maxillary, shorter pectoral, longer trunk, and with nape, shoulders, breast, and belly scaled, and with a developed lateral line.

Relationship is also close to *B. mollis*, which has also a slender, long pectoral, with exserted tips to the rays. *B. mollis* has also a faintly marked lateral line pursuing the same course as in *B. remigera*, but shorter. *Bothrocara* is described as having the palate toothless, but *B. mollis* usually develops asperities on the vomer and palatine bones, and has occasionally well-marked bands of vomerine and palatine teeth.

In addition to the type, 3 smaller specimens were obtained at the same locality. The species is also known from the following stations:

		<i>Fathoms.</i>
2923	Off San Diego.....	822
3075	Off the coast of Washington.....	859
3627	Off San Diego.....	776
4380	.....do.....	530

MELANOSTIGMA PAMMELAS Gilbert.

The type of this species was secured by the *Albatross* at station 3202, off Monterey Bay, California (not from the coast of southern Alaska, as given by Jordan and Evermann).¹ The three other specimens mentioned in the original description were from station 3126, also in the vicinity of Monterey. By the present collection, the range of the species is extended from Monterey to the vicinity of San Diego.

The 15 specimens secured vary widely in the amount of black pigment which they develop. The lining membranes of the mouth, gill-cavity, and body cavity are always jet black, and the anterior part of the head is externally blackish in all specimens. But the remaining parts vary from jet black through brownish black and gray to translucent, those from the same dredge haul usually agreeing in color. There is no evidence that this difference depends on the nature of the bottom, as all the specimens have been taken from green mud. But it is not improbable that this is a deep pelagic rather than a bottom form.

The fins were dissected out in one specimen, the dorsal containing 84 rays to middle of caudal, the anal 69 to middle of caudal, the pectoral 7 rays.

The jaws contain typically an outer series of widely spaced canines, but in some specimens these are much less developed, and may be scarcely larger than those behind them. In such cases the teeth are arranged in a band, rather than in a double series. The median tooth of the vomerine series may be enlarged and canine-like, or it may be no larger than the others. The extent to which the palatine series develops is variable, the series consisting in some cases of a few teeth at the extreme anterior end of the bone, in others extending farther back.

The minute size of the branchial opening sufficiently distinguishes this genus from *Bothrocara*.

List of stations.

		<i>Fathoms.</i>
4378	Off San Diego.....	376- 594
4425	Near Santa Cruz Island.....	1,084-1,100
4427	.....do.....	475- 510
4428	.....do.....	764- 891
4435	Santa Barbara Channel.....	274- 287
4512	Monterey Bay.....	334- 530
4513	.....do.....	389- 456
4514	.....do.....	394- 524
4540	.....do.....	389- 551
4541	.....do.....	381- 633
4543	.....do.....	118- 53

¹ Bull. 47, U. S. Nat. Mus., p. 2491.

CATAETYX RUBRIROSTRIS Gilbert.

Three specimens obtained at the following stations:

4317	Off San Diego.....	Fathoms. 161-510
4341	.....do.....	188-323
4418	.....do.....	238-310

LYCODAPUS DERMATINUS Gilbert.

Reexamination of the type of this species indicates that it is a well-marked form of which no second specimen apparently has been obtained. It belongs at the *fierasfer* end of the series, having fine teeth in the jaws, disposed in comparatively narrow bands, all concealed when mouth is closed; it has several teeth on the vomer and has comparatively slender gill-rakers, which are longer than they are wide at the base, and are 10 or 11 in number on anterior limb of outer gill-arch.

The vomerine teeth are characteristic, being stronger than any of the other teeth. They are 6 in number, canine-like, curved, the median teeth directed downward, those at the sides strongly outward and backward. In *L. fierasfer*, the vomerine teeth are minute and are typically 10 or 12 in number. Palatine teeth in *L. dermatinus* small, almost 10 in number, a wide interval separating them from the vomer. The fin rays apparently are less numerous in *L. dermatinus* than in any other species, the dorsal containing but 70 rays.

Measurements in hundredths of total length without caudal fin.

Length in millimeters to base of caudal.....	108
Length of head.....	21.5
Length of snout.....	6.2
Diameter of eye.....	3.8
Length of maxillary.....	9.8
Greatest width of head.....	8.5
Greatest depth of head.....	12
Distance from snout to anal.....	36
Distance from snout to dorsal.....	23
Length of pectoral.....	9
Length of caudal.....	4

LYCODAPUS MANDIBULARIS, new species.

Plate 20, fig. 20.

Type-specimen.—Cat. No. 75823, U.S.N.M., 165 mm. long, from station 4533, Monterey Bay, California, depth 144 to 293 fathoms.

Total length to base of caudal 160 mm., the following measurements in hundredths of this length: Length of head, 16.3; width of head, 7; interorbital width, 5; diameter of eye, 3.2; length of snout, 5; length of maxillary, 7; distance from tip of mandible to posterior

margin of gill-membrane, 9; from posterior margin of gill-membrane to upper end of gill-slit, 11.5; greatest depth at nape, 11; at anus, 9; distance from tip of snout to front of dorsal, 19; to front of anal, 34; length of pectoral, 5.

Dorsal, 88; anal, 78; caudal, 5 or 6; pectoral, 8.

The upper outline of head is straight, not longitudinally concave with spatulate snout as in *L. fierasfer*; snout abruptly decurved at tip; mandible massive, deep, the symphysis slightly protruding; maxillary reaching vertical from middle of eye; teeth coarse, much larger and in much broader bands than in *L. fierasfer*, but of approximately equal size; a pair of premaxillary teeth in inner row near median line, and three or four in inner mandibular row near middle of ramus sometimes but not always a little enlarged, more or less canine-like. Teeth in both jaws widely exposed in closed mouth, the outer series in the mandible not enlarged. As in other species of the genus, the mandibular teeth are anteriorly in a broad band, which abruptly narrows laterally to a single or irregular double series; premaxillary band broad anteriorly, tapering laterally, but not to a single series.

Vomerine teeth strong, reduced in number to a single pair, or sometimes but a single tooth is present. Palatine teeth well developed in a single long series, similar to those in the jaws. Gill-slit extending well above base of pectorals, as in all other species except *L. parviceps*. Gill-membranes joined anteriorly and free from the isthmus, the width of the free fold equaling diameter of eye, the posterior margin of membrane on the vertical descending from hinder margin of eye. Gill-rakers broader than high—strikingly different in this respect from *L. fierasfer*—spinous on the inner margin, reduced anteriorly to tubercles, 12 in all on the anterior limb of the outer arch, one only above the angle.

Two well-developed pseudobranchial filaments in all specimens examined. *L. fierasfer* is described as having no pseudobranchiae, and in the majority of specimens no trace of them is to be found. But on one side of an undoubted specimen of this species, a single filament is present.

Series of mucous pores on head inconspicuous.

The length of the head and trunk is contained 3 times in the total length; depth of body, $9\frac{2}{3}$; length of head, $6\frac{1}{4}$.

The anterior 6 dorsal rays are exceedingly slender, and are unsegmented, the fully segmented rays beginning abruptly behind them.

First 3 anal rays also unsegmented, but not otherwise different from the succeeding rays.

Color pale throughout on body and fins, dark specks sparsely distributed, somewhat more numerous posteriorly. Anterior part of mouth colorless, becoming black posteriorly, the branchial chamber somewhat dusky and the peritoneum black, but these are scarcely

visible externally. In paratypes the posterior part of body and the corresponding portions of the vertical fins become dusky.

Cotypes were taken at the following stations:

4461	Monterey Bay.....	<i>Fathoms.</i> 285-357
4468	.....do.....	32-309
4539	.....do.....	518-609

LYCODAPUS LYCODON, new species.

Plate 21, fig. 21.

Type-specimen.—Cat. No. 75822, U.S.N.M., 141 mm. long, from *Albatross* station 4509, Monterey Bay, depth 152 to 286 fathoms.

Measurements in hundredths of total length without caudal fin.

Length in millimeters to base of caudal.....	136
Length of head.....	16
Length of snout.....	5
Diameter of eye.....	3
Interorbital width.....	5
Length of maxillary.....	7.5
Greatest width of head.....	7.5
Greatest depth of head.....	9
Distance from snout to anal.....	34.5
Distance from snout to dorsal.....	18.6
Length of pectoral.....	6
Length of caudal.....	4

An elongate form with thick, loose skin, broad head, heavy jaws, very large teeth, and broad, short gill-rakers. In texture of the skin the species resembles *L. dermatinus*, but differs from it strikingly in proportions and in character of teeth and gill-rakers. It is most closely related to *L. mandibularis* and *L. grossidens*, but differs from both in proportions of head and body, in the general appearance, in the texture of the skin, and in the dentition, the palatine series of teeth being stronger than in any other known species.

The head is short, almost quadrate in cross section, the top of head broad and flat, the sides of head abruptly vertical. The premaxillary processes form a projection on snout, the upper profile of head otherwise straight. Nasal tubes short but evident, longer than in allied species. Mouth large, very oblique, the maxillary reaching a vertical line passing through eye just behind its middle. Jaws equal, with extremely broad dentigerous area, the teeth coarse, cardiform, widely spaced, many of them visible when the jaws are closed, and then failing to engage the teeth in the opposite jaw. The inner series of the mandible are somewhat enlarged and are directed backwards and towards the median line, a pair of the inner teeth near median line in premaxillaries are also a little enlarged. The largest teeth in the jaws are the external series in both upper and lower

jaws. These are widely spaced, are directed almost horizontally outward, are strongly curved, and are confined to the anterior half of the cleft of the mouth, 10 or 12 in number in each jaw. The vomer bears but a single tooth on one side the median line, equaling in size the smaller teeth in the jaws. Palatine bones with a single close-set series of short robust teeth, about 6 in number.

Gill-membranes rather broadly joined on the median line, wholly free from the isthmus, the free border on a vertical line from posterior border of eye. Gill-slit extremely oblique, extending above the pectoral for a distance equaling three-fourths width of pectoral base. Gill-rakers very short and broad, much broader than high, 10 on anterior limb of outer arch. Sensory pores on head strongly marked, especially 1 on middle of interorbital space, 1 above posterior margin of orbit, 2 in the nasal region, and a series of 3 on mandible. Several minute pores are evident on the preorbital, but none are visible elsewhere on head and none on sides of body. The skin is very thick and loose and renders it impossible to count the rays of the vertical fins without dissection.

The dorsal begins well behind the head, the posterior line of the occiput being midway between tip of snout and first dorsal ray. As in other species, the first rays are very slender and not jointed, the heavy articulated rays beginning with the tenth. All the rays are simple. Anterior 3 or 4 anal rays very slender, apparently not jointed.

Uniformly light in color, including the lining membrane of mouth and gill-cavity. Peritoneum jet black, not visible externally through the abdominal walls. On sides of head and body small dark spots are hidden under the thick integument.

Only the type known.

LYCODAPUS ATTENUATUS, new species.

Plate 21, fig. 22.

Type-specimen.—Cat. No. 75821, U.S.N.M., 163 mm. long, from station 4461, in Monterey Bay, depth 285 to 357 fathoms.

Measurements in hundredths of length to base of caudal:

Length of head, 14.8; of snout, 4.1; diameter of eye, 3; length of maxillary, 6.4; greatest width of head, 5.4; depth of head, 7.2; greatest depth of body, 6.4; depth at front of anal, 5; distance from tip of snout to front of dorsal, 16.3; to front of anal, 33; length of pectoral, 6.5.

Dorsal, 96; anal, 77; caudal rays not included in either case; pectoral, 7.

Body extremely attenuate, its depth less than that of head, less than one-fifteenth of total length.

Teeth coarse, in wide bands, not crowded, extensively exposed when mouth is closed; a pair in inner premaxillary series near median

line enlarged and pointed backwards; a few teeth along inner edge of middle of mandibular band somewhat enlarged; outer series on both jaws slightly enlarged, horizontally set, curved. A single vomerine tooth, smaller than those in jaws. Palatine teeth few in number, small but firm. Mouth not very oblique, the maxillary reaching vertical from middle of eye. Gill-rakers broad, short, 10 or 11 on horizontal limb of outer arch. Gill-slit extending above level of pectoral base for a distance equaling half diameter of eye. One or two well-developed pseudobranchial filaments present.

Skin thin, adherent, mucous pores very inconspicuous.

Color light, with scattered dark specks, not forming dark streaks along base of dorsal and anal as in *L. extensus*. The vertical fins become dusky towards tail. Mouth and gill cavity light or slightly dusky; peritoneum black, showing through the abdominal wall.

In its slender form this species resembles *L. extensus* and *L. parviceps*, but is apparently not closely related to either. From *L. parviceps* it differs in the wider gill-slit, which extends as in all other species save *parviceps*, above the base of the pectoral fin. From *L. extensus* it differs strikingly in the dentition, there being a single vomerine tooth and several short but rather strong teeth on each palatine, while *L. extensus* has numerous small vomerine teeth in a single series and no teeth on the palatine bones. Also, the upper outline of head is different, being straight with slightly prominent premaxillary processes in *L. attenuatus* and longitudinally concave with prominent occiput in *L. extensus*.

Direct comparison has been made with the type of *L. extensus*, but unfortunately that diminutive specimen is in a poor state of preservation, the vomerine teeth being lost.

L. attenuatus is closely related to *L. mandibularis*, *grossidens*, and *lycodon*, species with coarse teeth in wide bands, conspicuously exposed when the mouth is closed. They have also short, broad gill-rakers, which are broader at base than they are high. *L. attenuatus* differs from the others in its very elongate form and in the numerous rays in the vertical fins.

Only the type known.

The following species is here included, although from a more northern part of the coast:

LYCODAPUS GROSSIDENS, new species.

Type-specimen.—Cat. No. 75824, U.S.N.M., 105 mm. long, from station 3483, Bering Sea ($57^{\circ} 18' N.$; $171^{\circ} 18' W.$), depth 56 fathoms.

Total length to base of caudal, 102 mm., the following measurements in hundredths of this length: Length of head, 17.5; width of head, 7; bony interorbital width, 2; diameter of eye, 4; length of snout, 4.7; length of maxillary, 8; distance from tip of mandible to posterior margin of gill-membrane, 9; from posterior margin of gill-membrane to upper end of gill-slit, 10; greatest depth at nape, 9;

at anus, 7.5; distance from tip of snout to front of dorsal, 20; to front of anal, 36; length of pectoral, 5.

Dorsal, 81; anal, 72; caudal, 6; pectoral, 5.

Upper contour of head obliquely descending from occiput in a straight line, the occiput slightly depressed; snout not so deep as in *L. mandibularis*, the mandible less massive. Maxillary reaching a vertical dropped from posterior edge of pupil; jaws equal, the mandible not protruding. Teeth larger than in any other species of the genus, the anterior series in the symphyseal half of the mandible developed as curved canines, at first directed horizontally, and not opposed to any in the upper jaw. The outer series in the premaxillaries are sometimes also enlarged to form similar but smaller canines. Both mandibular and premaxillary teeth are in moderately broad bands anteriorly, the mandibular band is abruptly constricted posteriorly to a single series, the premaxillary band is narrowed laterally and in both jaws the lateral teeth are much reduced in size. Only one or two vomerine teeth present, the palatines in a single series, all very small.

Gill-slit extending well above base of pectorals; gill-membranes anteriorly joined and free from the isthmus, the posterior margin crossing the isthmus at a point slightly posterior to the mandibular joint. Gill-rakers short and rather broad, but narrower than in *mandibularis*, 11 or 12 on anterior limb of outer arch. Two or three short pseudobranchial filaments.

Mucous pores inconspicuous, but evident on top and sides of head, and in a short series on body immediately behind the head.

Ten or 11 anterior dorsal rays slender and unsegmented, the anterior 3 anal rays also unsegmented.

Color light, with sparse black specking on the body, this becoming more pronounced on posterior part of the body and on the vertical fins. Inside of mouth and gill-cavity largely black, as is also the peritoneum, the silvery pigment of the abdomen masking the black from without.

In addition to the type are 5 paratypes from station 4257, near Funder Bay, southeastern Alaska, depth 350 fathoms. One of these a young specimen.

NEMATONURUS ABYSSORUM, new species.

Plate 21, fig. 23.

Type-specimen.—Cat. No. 75827, U.S.N.M., 803 mm. long, from station 4390, off Santa Catalina Island, lat. $33^{\circ} 02' 15''$ N.; long. $120^{\circ} 42'$ W.; depth, 1,350 to 2,182 fathoms.

Dorsal, II, 10; pectoral, 19; ventral, 11.

Body deep; head without prominent ridges, projecting angles, or enlarged canals, the texture unusually firm. Anterior profile descending in an even curve from front of dorsal to tip of snout, the

lower profile of snout nearly horizontal. Snout short, depressed, its axial length 0.19 length of head, the distance from tip of snout to front of eye 0.23, from tip of snout to front of premaxillaries 0.11. Interorbital space very slightly convex, firm throughout and without ridges, a slightly depressed area on front of occiput. Interorbital width, 0.25 length of head; horizontal diameter of the oval eye, 0.21; maxillary extending beyond the orbit, 0.39; length of barbel, 0.16. A series of rather small conical teeth in each jaw, a very few similar but smaller teeth forming an inner series in the front of the upper jaw, the mandible with an inner pair at symphysis; teeth in lower jaw somewhat smaller than those above. Anterior nostril a widely opened cup, at the bottom of which the sensory membrane lies exposed. The walls of the posterior nostril are thin and the wide short tube is collapsed. Cheeks and suborbital area nearly vertical, without ridges. Preopercular margin nearly vertical, a little incurved above the angle, which gently protrudes. Branchiostegals, 6.

Dorsal originating just behind vertical from pectoral axil, the second spine smooth throughout, but with a few soft, not spinous, points on the anterior margin near tip, which are probably retrograded spinules. The tip of the spine protrudes beyond the rest of the fin as a very short filament, the length of the spine is 0.61 of length of head; base of first dorsal, 0.34; interspace between dorsals, 0.66. Length of pectorals, 0.62; outer ventral ray filamentous, its tip scarcely attaining the vent, 0.61. Vent immediately in front of origin of anal.

Pores of sensory canals large, the lateral line conspicuous, marked by a superficial, more or less interrupted, tube extending over the scales. Underside of snout thickly beset by small tubercles which probably have a sensory function. Similar structures accompany the lateral line, especially in its anterior part, certain of these being arranged in pairs, one immediately above the lateral line, the other vertically below it.

Scales on head rough, with three to five gently diverging ridges, which bear short spines along their course and do not project beyond the edge of the scale. Scales greatly reduced in size on lower part of cheeks, around the orbits and on snout. Lower side of head, including inferior surface of snout, the mandibles and the branchiostegal membranes, wholly scaleless. Scales on breast somewhat reduced in size and rough like those on head. Those on remainder of body have the margins entire, the rough area confined to the central portion of the scale within the margin, and often reduced to a few spinelets in a single median ridge.

Color: Head, body, and fins dark brown, blackish on breast and belly, and along edge of gill-membranes. Lining of mouth and gill-cavity and the peritoneum black.

Only the type known.

MACROURUS ACROLEPIS Bean.

List of stations.

		<i>Fathoms.</i>
4336	Off San Diego.....	518-565
4380	Off Coronado Islands.....	530-618
4387a	Off San Diego.....	1,059
4391	Off Santa Catalina Island.....	675-1,350
4405	Off San Clemente Island.....	654-704
4542	Monterey Bay.....	331-677

MACROURUS STELGIDOLEPIS Gilbert.

Station 4306, off San Diego, 207-497 fathoms.

LIONURUS LIOLEPIS (Gilbert).

List of stations.

		<i>Fathoms.</i>
4307	Off San Diego.....	169-496
4317	do.....	161-510
4333	do.....	301-487
4334	do.....	514-541
4335	do.....	500-530
4351	do.....	423-488
4353	do.....	628-640
4380	do.....	530-618
4400	Off San Clemente Island.....	500-507
4402	do.....	542-599
4405	do.....	654-704
4407	Off Santa Catalina Island.....	334-600
4415	Off Santa Barbara Island.....	302-638
4416	do.....	323-448
4423	Off San Nicholas Island.....	216-339
4425	do.....	1,084-1,100
4427	Off Santa Cruz Island.....	447-510
4428	do.....	764-891
4429	do.....	506-680
4507	Monterey Bay.....	308-383
4516	do.....	718-756

The pyloric caeca in this species are small, numerous, about 35 in number. The ventrals have 10 or 11 rays; branchiostegal rays, 7. The bands of teeth are villiform rather than cardiform, as originally described, the band rather wide, a distinct outer series of canines in upper jaw.

Scales largely fallen in all specimens, the few remaining showing that those on top and upper part of sides of head and on breast bear several (usually 4 or 5) parallel or weakly diverging series of spinules; scales of adjacent areas may show faint ridges, the others are smooth, unmarked.

LYOPSETTA EXILIS (Jordan and Gilbert).

Nothing is known concerning the southern limit of this species. It is very abundant along the coast of California, and has been dredged by the *Albatross* off the coasts of Oregon and Washington, British Columbia, and southeastern Alaska as far north as Wrangell. The depth is known to range from 40 to 200 fathoms.

The dorsal rays range from 77 to 85, most frequently 80 or 81; anal rays from 59 to 65, most frequently 61 or 62. There are usually

2, rarely 3, gill-rakers above the angle of outer arch; 9 to 11, rarely 12, below angle.

List of stations.

		Fathoms.
4305	Off San Diego.....	67-116
4309	.....do.....	67-78
4310	.....do.....	71-75
4311	.....do.....	110-143
4322	.....do.....	110-199
4356	.....do.....	120-131
4359	.....do.....	98-220
4364	.....do.....	101-129
4365	.....do.....	130-158
4366	.....do.....	176-181
4410	Off Catalina Island.....	178-195
4413	.....do.....	152-162
4447	Monterey Bay.....	52-42
4452	.....do.....	49-50
4455	.....do.....	62-56
4457	.....do.....	46-40
4460	.....do.....	55-167
4475	.....do.....	142-58

PSETTICHTHYS MELANOSTICTUS Girard.

List of stations.

		Fathoms.
4459	Monterey Bay.....	13-15
4477	.....do.....	11-19

HIPPOGLOSSINA STOMATA Eigenmann and Eigenmann.

Characterized by its large mouth, numerous gill-rakers, the large size of the scales on head and sides of body, the light and dark mottling of the vertical fins, and the sharply marked series of ocelli near dorsal and anal contours. In size of scales and in coloration this species agrees entirely with *H. bollmanni* Gilbert, from the coast of Ecuador, but the latter differs conspicuously in the reduced size and number of gill-rakers and in the shorter maxillary. *H. macrops* Steindachner, is known only from Mazatlan, Mexico, and from a single specimen collected by the late Admiral Beardslee, United States Navy, at Valparaiso, Chile. The gill-rakers in *H. macrops* are similar to those in *H. stomata*, but the maxillary is much shorter and more slender, and the scales on head are reduced in size and are crowded in much more numerous series than in *H. stomata*. The number of pores in the course of the lateral line is not materially increased in *macrops*, but the number of scales in a transverse series is greater, there being 27 to 30 in an oblique series from a point on lateral line just behind the arch upward and backward to base of dorsal, while in *stomata* and *bollmanni* there are 19 to 21 scales in a corresponding series. Steindachner's figure of *H. macrops* indicates faintly marked series of paired spots, with entire absence of ocellation, and uniformly dusky vertical fins. In the Valparaiso specimen, better marked ocelli are present, but the vertical fins are plain dusky. There is no trace of the pair of blackish spots just in front

of caudal fin on outlines of caudal peduncle, which are so conspicuous in *stomata* and *bollmanni*. In *stomata* there is a narrow rounded cutaneous flap, with conspicuous white margin, on lower edge of interopercle just behind mandibular articulation. This is present, though smaller, in *bollmanni*, and is barely perceptible in *macrops*.

H. stomata was originally known from two specimens taken in deep water off San Diego. It has since been dredged by the *Albatross* at a number of stations between Point Conception and Ballenas Bay, Lower California, these being the limits of the range so far as now known. The depth at which it has been taken ranges from 21 to 74 fathoms. By the expedition of 1904 a single specimen was obtained at station 4303, off San Diego, at a depth of 21 to 24 fathoms.

A table of measurements of *H. stomata*, *H. bollmanni*, and *H. macrops* is appended for purposes of comparison.

Measurements in hundredths of length without caudal.

	<i>Stomata.</i>		<i>Bollmanni.</i>		<i>Macrops.</i>
	Station 4303.	Station 2977.	Station 2805.		Valparaíso, Chile.
Length of head.....	34	36	34.5	33.5	33.5
Length of snout (from upper orbit).....	6.5	7.8	6.8	6.5	6.5
Longest (oblique) diameter of upper orbit.....	11	11.3	10.5	11.3	10.2
Length of maxillary.....	16	16.5	14	14	12.9
Greatest width of maxillary.....	3	3.2	2.8	3	2.2
Greatest depth of body.....	43	39	37.5	38.5	41
Least depth of caudal peduncle.....	10.5	8	9	9	9.7
Chord of arch of lateral line.....	19	19	17.5	19	19
Length of pectoral.....	18	17	16	16	17
Length of caudal.....	24	22.5	22	23	25
Length of longest gill-raker.....	3.5	3.2	2.5	3	2.3
Number of gill-rakers on outer arch.....	6+13	5+13	2+8	3+8	5+12
	5+14	5+16	2+9	3+9	5+12
Number of dorsal rays.....	67	64	65	64	68
Number of anal rays.....	51	49	50	51	53
Number of tubes in lateral line.....	71	74	76	73	80
Length in millimeters to base of caudal.....	197	221	137	136	175

PLEURONICHTHYS VERTICALIS Jordan and Gilbert.

4420	Off San Nicolas Island.....	<i>Fathoms.</i> 33-32
4442	Monterey Bay.....	26-31

PLEURONICHTHYS DECURRENS Jordan and Gilbert.

4422	Off San Nicolas Island.....	<i>Fathoms.</i> 31-32
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PLEURONICHTHYS RITTERI Starks and Morris.

4304	Off San Diego.....	<i>Fathoms.</i> 25
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PAROPHRYS VETULUS Girard.

4459	Monterey Bay.....	<i>Fathoms.</i> 13-15
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LEPIDOPSETTA BILINEATA (Ayres).

4420	Off San Nicolas Island.....	Fathoms. 33-32
4474	Monterey Bay.....	43-34

Not hitherto reported from any point south of Monterey Bay.

MONOCERATIAS, new genus (*Ceratiidae*).

Most closely allied to *Diceratias (bispinosus)*, differing in the much less oblique mouth, in the absence of the second cephalic spine, in the naked skin, and in the presence of a strong outwardly directed spine at the angle of the preopercle. From *Oneirodes* and *Paroneirodes*, it is distinguished by the single dorsal spine.

Body short and deep, compressed, the abdomen subglobular, the occipital region elevated and strongly convex. Mouth of moderate size and somewhat oblique, with unequal depressible teeth in jaws and on vomer. Gills $2\frac{1}{2}$, the outer arch without filaments. Dorsal spine single, the basal joint procumbent, not concealed; no caruncles. Skin with few scattered soft papillæ of small size. Pectoral multi-radiate. Gill-opening very wide, behind and below base of pectoral.

Type of the genus.—*Monoceratias acanthias*, new species.

MONOCERATIAS ACANTHIAS, new species.

Plate 22, fig. 24.

Type-specimen.—Cat. No. 75825, U.S.N.M., 80 mm. long, from station 4428, off Santa Cruz Island, Cal., depth 764 to 891 fathoms.

Dorsal, 6; anal, 4; pectoral, 15; caudal, 9.

Occipital region elevated, its profile strongly convex; interorbital fossa wide and deep; supraorbital rim widening behind, with an inner and an outer ridge, the intervening surface gently concave; the inner pair of ridges low and parallel, bounding the interorbital fossa, the outer pair higher, strongly divergent, each ending in a strong spine, directed obliquely upwards, outwards, and backwards; anteriorly, where the two ridges join, each rim is abruptly incurved, presenting a notched appearance seen from above. Least interorbital width at the notch three-tenths the distance between the supraorbital spines.

Mouth little oblique, the lower jaw strongly protruding beyond the upper, ending in an acute symphyseal process. Mandibular teeth depressible, in a single irregular series, longer and shorter teeth alternating, 13 to 15 in number; premaxillary teeth less than half the size of the mandibular teeth, otherwise similar, a wide median area toothless; vomer with 3 teeth on each side, in a single series, the median area naked; inner vomerine teeth minute, the middle pair of each group a little larger, the outer pair about as large as the largest mandibular teeth.

Two interlocking spines at the angle of the preopercle, the outer on the preopercle, directed outward and slightly downward, the inner on the mandibular margin, directed backward and slightly upward. A well-developed knob at the articulation of the maxillary. Rostral spine with long free basal joint projecting slightly beyond the upper lip, and half as long as the terminal joint, which reaches when depressed to a point above the middle of the orbit; the free end is somewhat enlarged, laterally compressed, provided anteriorly with a lappet or cirrus and posteriorly with a short fleshy process.

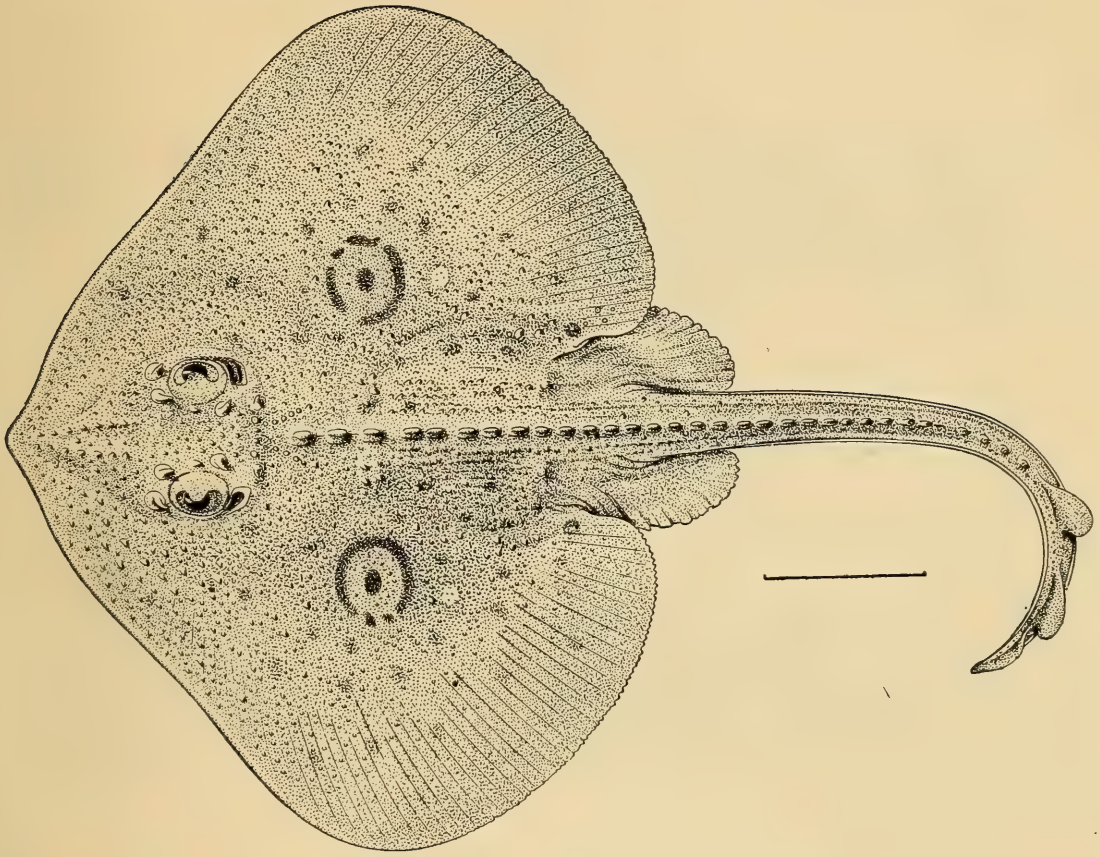
Upper end of gill slit behind middle of pectoral, the slit extending below the fin for more than the width of the pectoral base.

Papillæ minute, sparsely distributed everywhere on head and body.

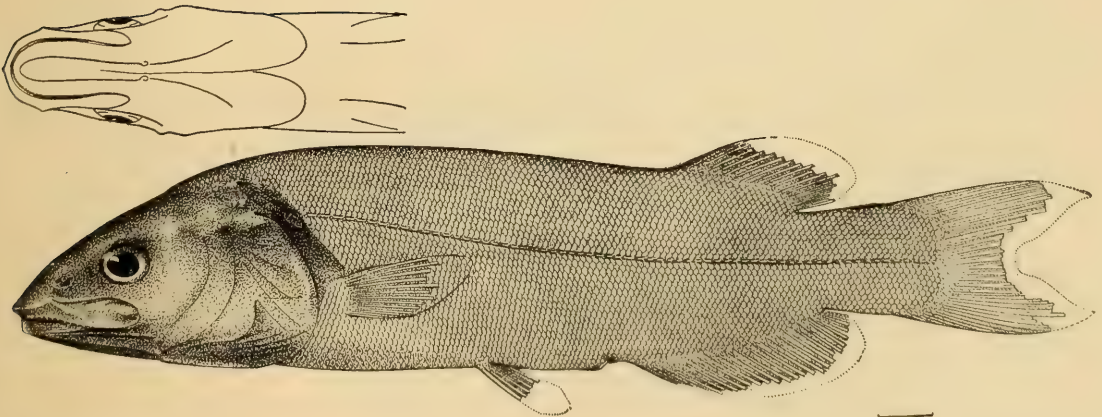
Measurements in hundredths of length without caudal:

Length of maxillary (from articulation).....	34
Greatest depth of body.....	69
Length of head.....	65
Least interorbital width.....	10
Distance between supraorbital spines.....	26
Length of gill slit.....	22
Basal joint of rostral spine.....	12
Terminal joint of rostral spine.....	24
Distance from tip of snout to dorsal.....	75
Distance from tip of snout to anal.....	84
Length from tip of snout to base of caudal in millimeters.....	62

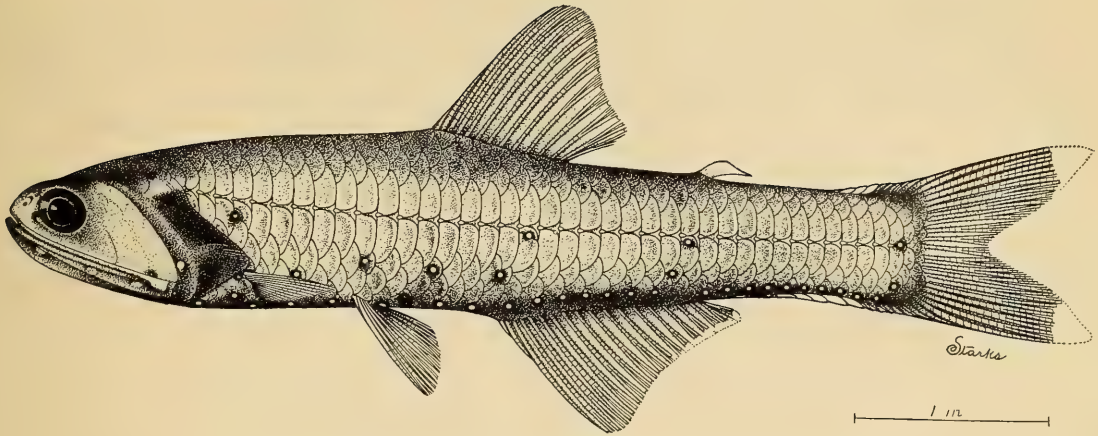
A single specimen known.



1. *RAJA MONTEREYENSIS*. (PAGE 307.) FROM THE TYPE.



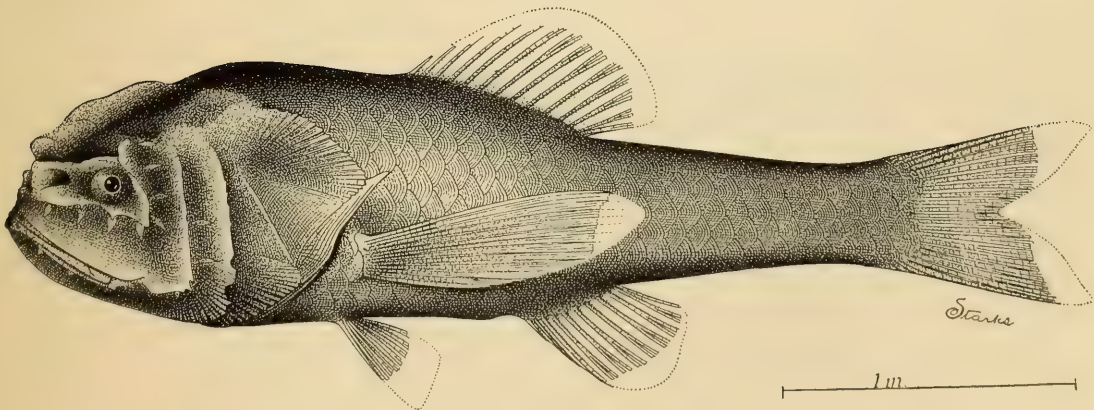
2. *XENOGNATHUS PROFUNDORUM*. (PAGE 311.) FROM THE TYPE.



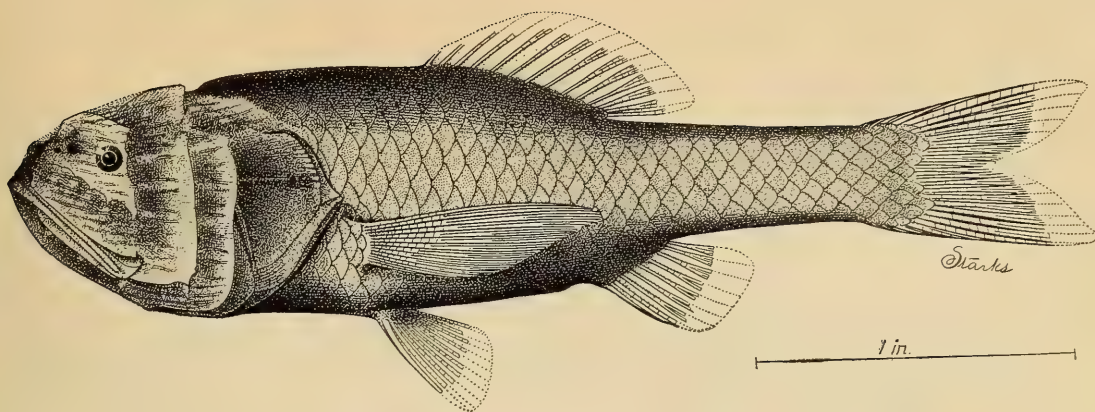
3. LAMPANYCTUS RITTERI. (PAGE 318.) FROM THE TYPE.



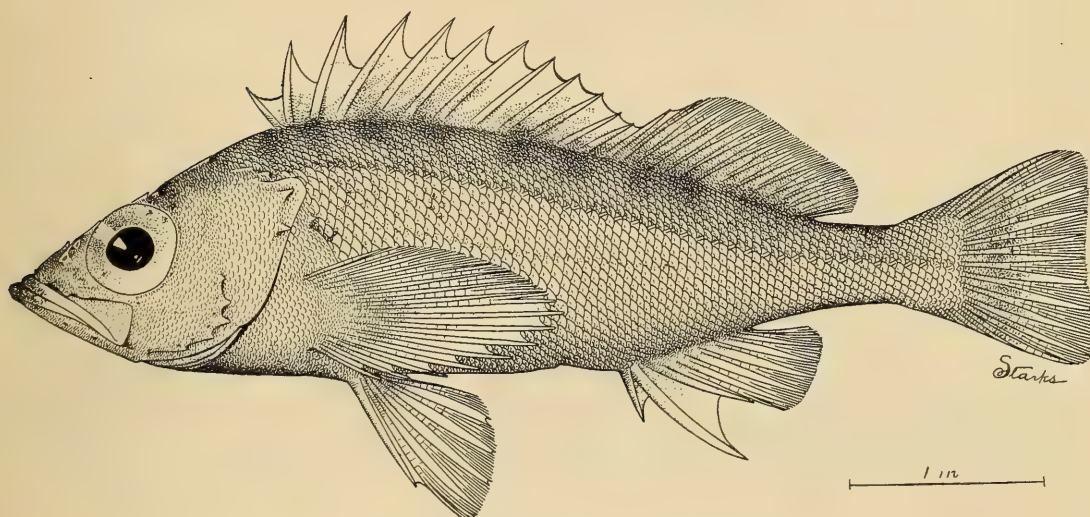
4. ZASTOMIAS SCINTILLANS. (PAGE 322.) FROM THE TYPE.



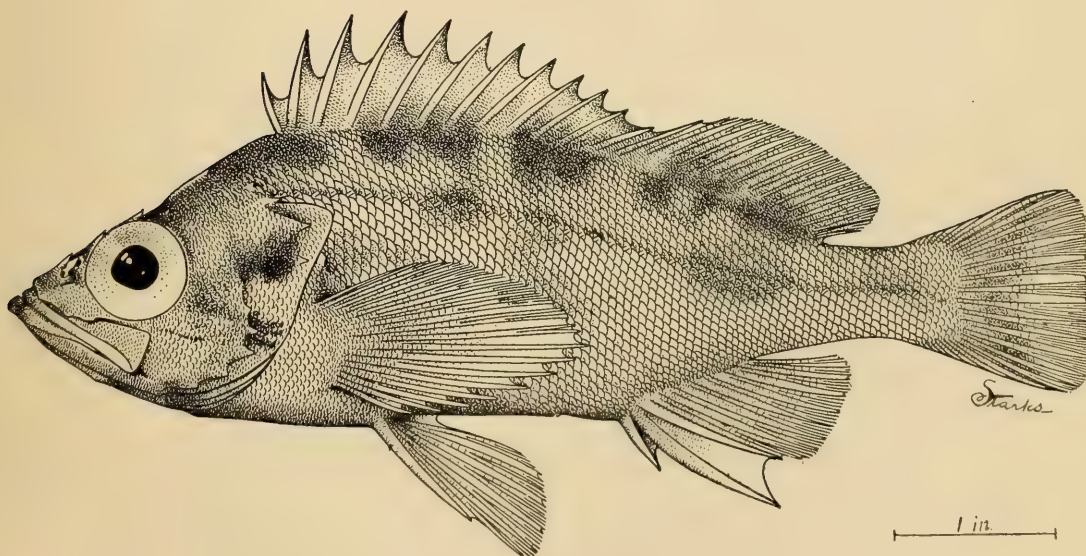
5. MELAMPHAES BISPINOSUS. (PAGE 325.) FROM THE TYPE.



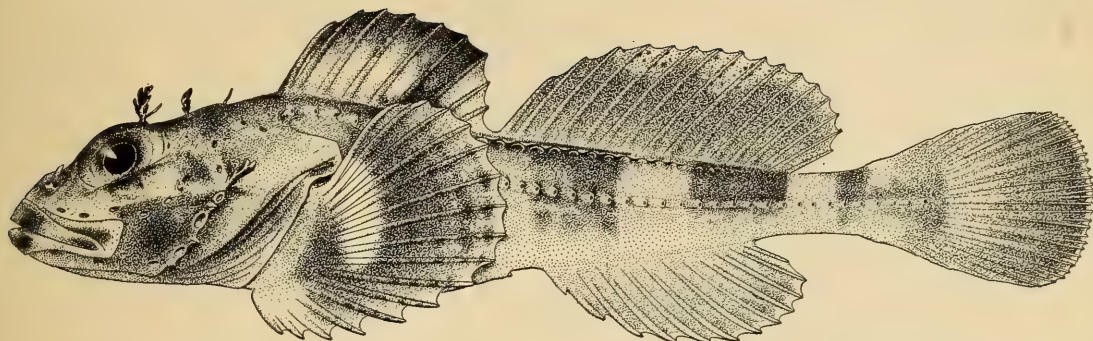
6. MELAMPHAËS NYCTERINUS. (PAGE 326.) FROM THE TYPE.



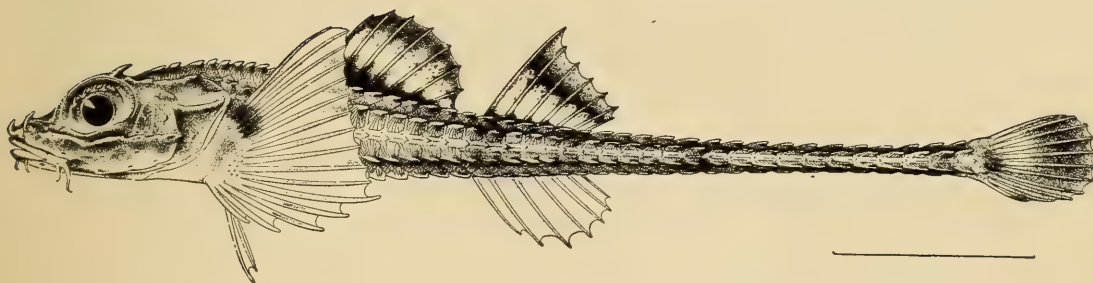
7. SEBASTODES ZACENTRUS. (PAGE 331.)



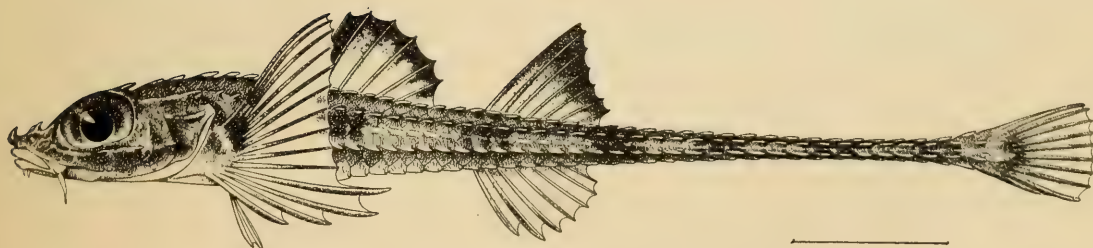
8. SEBASTODES WILSONI. (PAGE 333.) FROM THE TYPE.



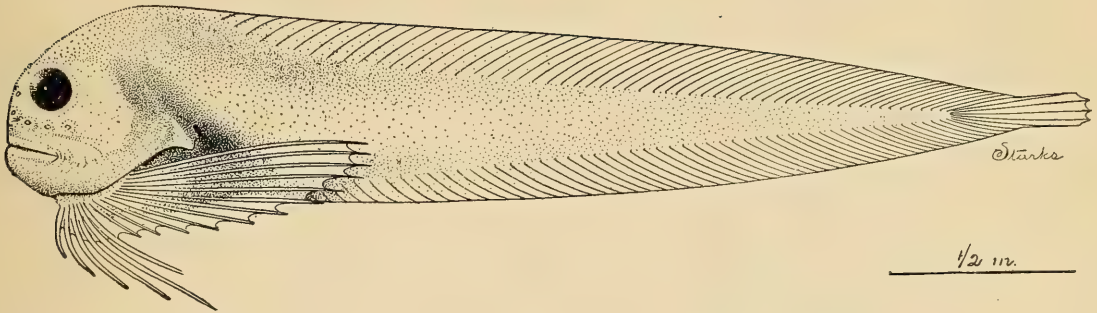
9. *ICELINUS FUSCESCENS*. (PAGE 340.) FROM THE TYPE.



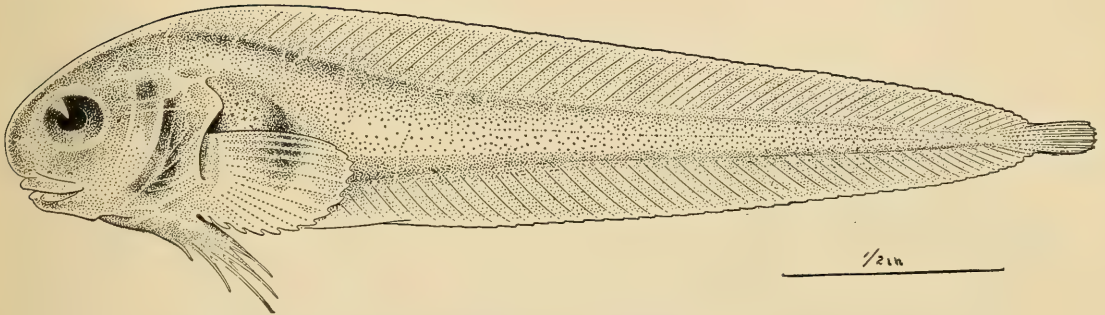
10. *XENERETMUS LEIOPS*. (PAGE 348.) FROM THE TYPE.



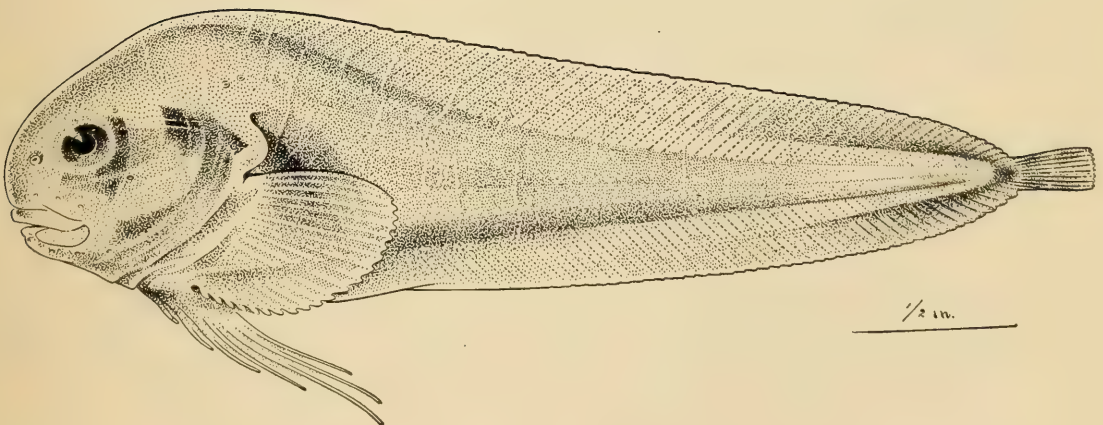
11. *XENERETMUS RITTERI*. (PAGE 350.) FROM THE TYPE.



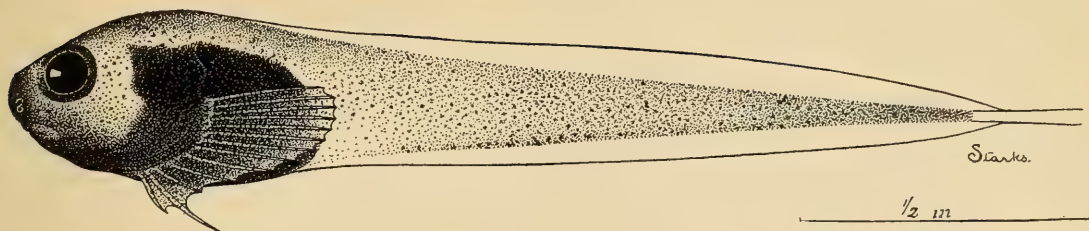
12. PARALIPARIS MENTO. (PAGE 354.) FROM THE TYPE.



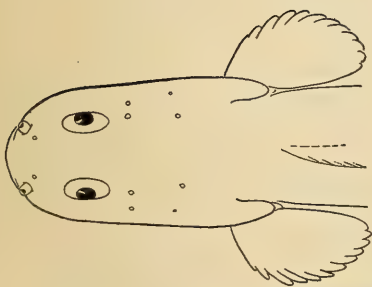
13. PARALIPARIS ALBESCENS. (PAGE 355.) FROM THE TYPE.



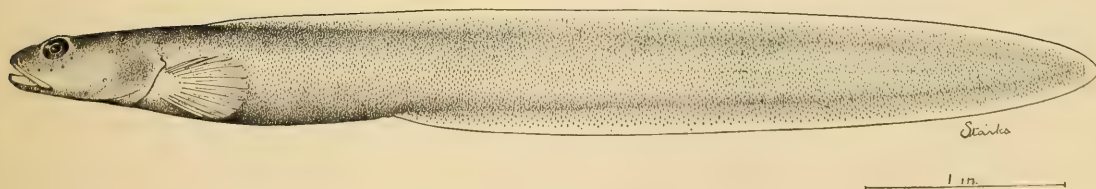
14. PARALIPARIS CAUDATUS. (PAGE 356.) FROM THE TYPE.



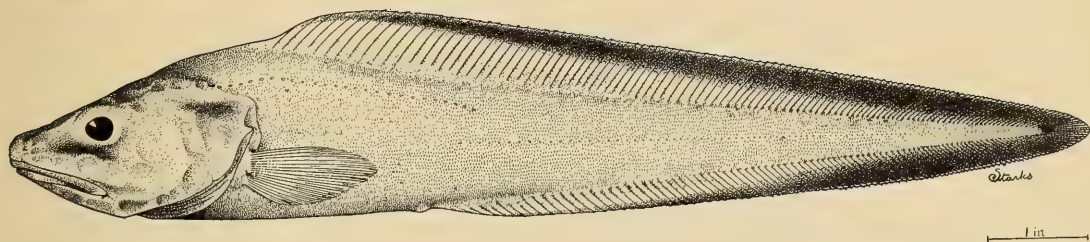
15. LIPARISCUS NANUS. (PAGE 358.) FROM THE TYPE.



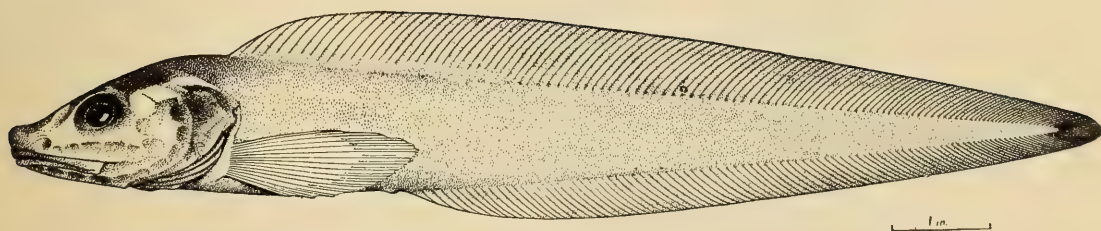
16. EMBRYX PARALLELUS. (PAGE 360.) FROM THE TYPE.



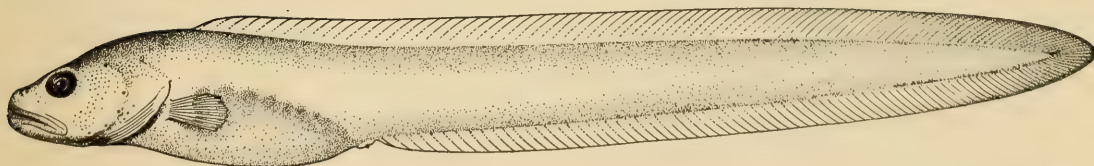
17. MAYNEA CALIFORNICA. (PAGE 362.) FROM THE TYPE.



18. *LYCOGRAMMA BRUNNEA*. (PAGE 364.)



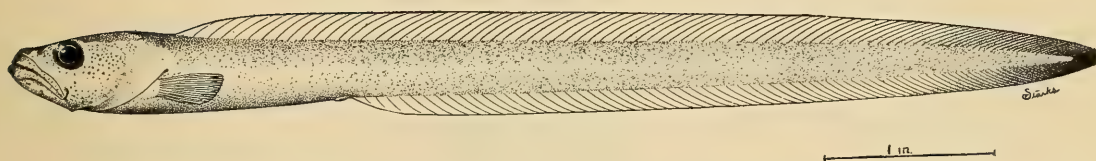
19. *BOTHROCARA REMIGERA*. (PAGE 366.) FROM THE TYPE.



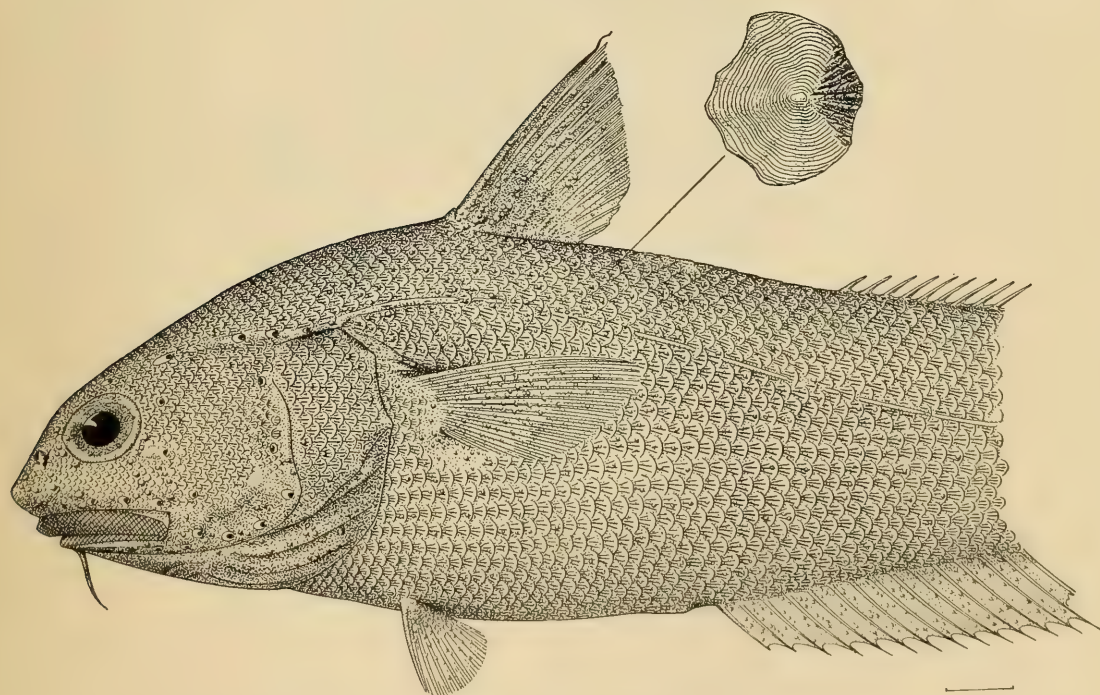
20. *LYCODAPUS MANDIBULARIS*. (PAGE 369.) FROM THE TYPE.



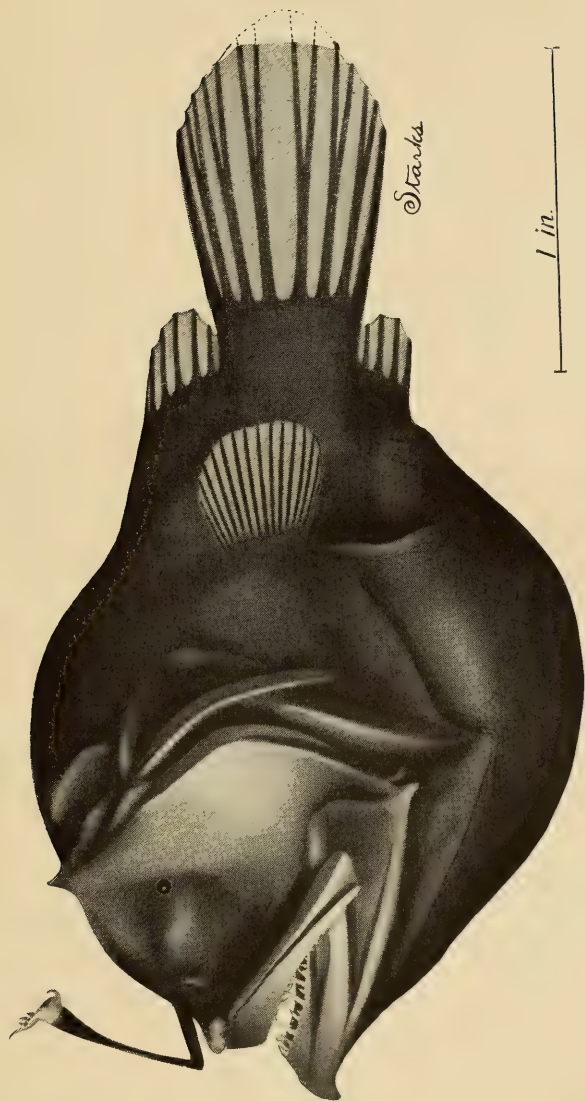
21. *LYCODAPUS LYCODON*. (PAGE 371.) FROM THE TYPE.



22. *LYCODAPUS ATTENUATUS*. (PAGE 372.) FROM THE TYPE.



23. *NEMATONURUS ABYSSORUM*. (PAGE 374.) FROM THE TYPE.



24. MONOCERATIAS ACANTHIAS. (PAGE 379.) FROM THE TYPE.

DESCRIPTIONS OF NEW AFRICAN BIRDS OF THE GENERA
FRANCOLINUS, CHALCOPELIA, CINNYRIS, CHALCOMI-
TRA, ANTHREPTES, ESTRILDA, HALCYON, MELITTO-
PHAGUS, AND COLIUS.

By EDGAR A. MEARNs,
Associate in Zoology, United States National Museum.

Five of the fourteen forms of African birds here described are from the collection made by the Childs Frick African Expedition, 1911-12; three are from the Paul J. Rainey African Expedition, 1911-12; five are from the Smithsonian African Expedition, 1909-10 collection, made under the direction of Col. Theodore Roosevelt; and one is from the African collection made by Dr. W. L. Abbott in 1888 and 1889.

The names of special tints and shades of colors used in this paper conform to Mr. Robert Ridgway's Color Standards and Color Nomenclature, issued March 10, 1913.¹ All measurements are in millimeters.

FRANCOLINUS HILDEBRANDTI HELLERI, new subspecies.

HELLER'S FRANCOLIN.

Type-specimen.—Adult male, Cat. No. 217550, U. S. Nat. Mus.; collected in the juniper forest at the summit of Mount Lololokui, altitude 6,000 feet, British East Africa, September 21, 1911, by Edmund Heller. (Original number, 382.)

Characters.—Most closely related to *Francolinus hildebrandti hildebrandti* Cabanis, from Ndi, Teita, British East Africa, and *F. h. altumi* Fischer and Reichenow, from Lake Naivasha, British East Africa.² It is slightly larger than typical *hildebrandti*, and the male has a deeper, richer coloration above, and purer black and white on the middle under parts; and the female is of a darker, olivaceous, brown above, and a much darker cinnamon color below, unrelieved by whitish edging to the feathers. While the male is equally dark, it is much less grayish on the upper parts than *altumi*, in which the female is much paler cinnamon below. The differences in these three forms may be expressed as follows:

¹ The date on the title-page is 1912 (=January 16, 1913, when a few copies were distributed). The work was generally distributed March 10, 1913.

² In a recent letter Doctor Reichenow informed us that Lake Naivasha is the type-locality of *altumi*.

<p><i>Francoelinus hildebrandti hildebrandi.</i></p> <p>MALE.</p> <p>Upper parts paler, more yellowish, brown. Under parts duller, less pure black and white.</p> <p>Chin and upper throat dirty white, the feathers with small, central, dark spots. Flanks and crissum paler, with faint central markings and pale rusty borders to the feathers. (Outer aspect of thigh saccado's olive. Measurements (average of three): Wing, 179; tail, 103; culmen, measured from anterior edge of frontal membrane, where the horny sheath begins, 20; tarsus, 53; longest spur, 13.5.</p> <p>FEMALE.</p> <p>General color paler; upper parts more rufescent, with coarser markings. Middle under parts cinnamon, the feathers with whitish terminal spots or edging. Measurements (average of two): Wing, 173; tail, 101; culmen (chord), 17.5; tarsus, 49.5; longest spur, 8.5.</p>	<p><i>Francoelinus hildebrandti altumi.</i></p> <p>MALE.</p> <p>Upper parts darker, more grayish, brown. Under parts brighter, with pure black spots and pure white borders to the feathers.</p> <p>Chin and upper throat whiter, with larger black central spots to the feathers. Flanks and crissum darker, with more distinct dark markings and pale olive-grayish borders to the feathers. Outer aspect of thigh buffy brown. Measurements (average of two topotypes): Wing, 190; tail, 105; culmen (chord), 20.3; tarsus, 54; longest spur, 13.5.</p> <p>FEMALE.</p> <p>General color darker; upper parts more grayish, with finer markings. Middle under parts pinkish cinnamon, with narrower, more grayish terminal edging. Measurements (average of two topotypes): Wing, 177; tail, 97; culmen (chord), 18.5; tarsus, 49; longest spur, 11.7.</p>	<p><i>Francoelinus hildebrandti helleri.</i></p> <p>MALE.</p> <p>Upper parts rufescent brown. Under parts with pure black spots, but broader white borders to the feathers of chest and flanks. Chin and upper throat white, with smaller black central spots to the feathers. Flanks and crissum sharply marked with brown, black-edged cross-bands and with buffy edges to the feathers. Outer aspect of thigh olive-brown. Measurements (two, type and topotype): Wing, 188; tail, 110; culmen (chord), 19.5; tarsus, 49.5; longest spur, 12.</p> <p>FEMALE.</p> <p>General color of upper parts deeper, more olivaceous brown, with fine markings. Middle under parts uniform orange-cinnamon. Measurements (one topotype): Wing, 170; tail, 101; culmen (chord), 19; tarsus, 46; longest spur, 6.5.</p>
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Measurements of type (adult male).—Length of skin, 315; wing, 191; tail, 110; culmen, from anterior border of frontal membrane, chord, 20; tarsus, 50; longest spur, 12.

CHALCOPELIA AFRA KILIMENSIS, new subspecies.

MOUNT KILIMANJARO METALLIC-SPOTTED DOVE.

Type-specimen.—Adult male, Cat. No. 117864, U.S.N.M.; collected at 5,000 feet altitude on Mount Kilimanjaro, German East Africa, June 8, 1888, by Dr. W. L. Abbott.

Characters.—Most closely related to *Chalcopelia afra* (Linnæus)¹ and to *C. a. abyssinica* (Sharpe)². In size, the three forms, *afra*, *abyssinica*, and *kilimensis*, are quite similar; but they differ considerably in coloration. The differences in color may be expressed as follows:

<i>Chalcopelia afra afra.</i>	<i>Chalcopelia afra abyssinica.</i>	<i>Chalcopelia afra kilimensis.</i>
Bill dusky red, with only the apical portion yellow. Forehead narrowly grayish white. Mantle and inner wing-feathers drab. Chest light brownish drab. Abdomen pale pinkish buff.	Bill with basal half bright red, terminal half yellow. Forehead broadly grayish white. Mantle and inner wing-feathers hair brown. Chest pale vinaceous-drab. Abdomen pinkish white.	Bill dusky red, with the terminal fifth yellow. Forehead narrowly grayish white. Mantle and inner wing-feathers saccardo's umber. Chest brownish drab. Abdomen pale pinkish cinnamon.

An immature female (Cat. No. 117862, U.S.N.M.) topotype has the abdomen more buffy and the feathers of the sides cross-banded with pale hair brown.

Measurements of type (adult male).—Length of skin, 197; wing, 111; tail, 88; culmen (chord), 14.5; tarsus, 19.5.

Average measurements of two adult males (including the type).—Wing, 108.5; tail, 91.5; culmen (chord), 14.5; tarsus, 19.3.

Measurements of adult female (Cat. No. 117863).—Length of skin, 180; wing, 88; culmen, 14.5; tarsus, 18.

Material.—Four topotypes from Mount Kilimanjaro, the only examples of this form seen by the author.

CHALCOPELIA CHALCOSPILA (Wagler).

SENEGAL METALLIC-SPOTTED DOVE.

This species, originally described from "Senegal," West Africa,³ is represented in the collection before me by five subspecies,⁴ four of

¹ Syst. Nat., Twelfth ed., vol. 1, 1766, p. 284 (Senegal).
² Bull. Brit. Orn. Club, vol. 12, 1902, No. 90, p. 83 (Kokai, Bogos Land, Abyssinia).
³ *Columba chalcospilos* Wagler, Syst. Avium, 1827 (*Columba*, sp. 83), p. [258] (Senegal).
⁴ Two additional subspecies have been named from South Africa, as follows:
Chalcopelia chalcospila volkmanni Reichenow, Journ. f. Ornith., 1902, p. 134 (Damara Land).
Chalcopelia chalcospila caffra Reichenow, Journ. f. Ornith., 1902, p. 134 (Southeastern Africa).

which occur in Northeast Africa, each represented by a series of specimens. Mr. H. C. Oberholser¹ has pointed out the distinctions between three previously recognized forms, *Chalcopelia chalcospila chalcospila* (Wagler) from Senegal, *C. c. somalica* Erlanger from Somali Land, and *C. c. acanthina* Oberholser from Mount Kilimanjaro, in German East Africa.

The two new subspecies described below may be readily distinguished from the three above-mentioned forms by their darker coloration. The West African forms, *chalcospila* and *volkmanni*, are somewhat smaller than those from East Africa, but the latter exhibit but slight variation in size.

The author agrees with Doctor Sharpe in considering *Chalcopelia delicatula* of the White Nile region to be a distinct species.

CHALCOPELIA CHALCOSPILA INTENSA, new subspecies.

HAWASH METALLIC-SPOTTED DOVE.

Type-specimen.—Adult male, Cat. No. 243506, U.S.N.M.; collected on the Hawash River, Abyssinia, February 11, 1912, by Edgar A. Mearns. (Original number, 20178.)

Description of adult male and female.—An adult female, mated with the type, is indistinguishable from it except by its slightly smaller size. Crown gray (dark gull gray), paler on forehead and sides of head; upper side of neck, and mantle, hair brown; exposed portion of wing-coverts and inner secondaries superficially grayish drab, with darker bases and inner webs to the feathers; primaries kaiser brown at base, with broad dark brown tips, which are narrowly edged with whitish drab, and with black outer webs to the five outer quills; some of the inner median wing-coverts and some of the scapulars with metallic golden-green spots, some portions of which in certain lights appear dusky purple; lower back crossed by two broad black bands, and between them an avellaneous one; upper tail-coverts light drab, broadly edged with black at tip; central rectrices light drab, becoming black apically, the outer ones gray at base and broadly black terminally, the three outermost narrowly tipped with pale drab or pale gray; under side of rectrices black, with pale edging to the tips of some of the outer feathers and with pale gray outer webs to the basal third of the outer feather; under tail-coverts black centrally with considerable white laterally; chin pinkish white, deepening on the lower throat, chest, and upper abdomen to brownish vinaceous, this paling on the lower abdomen to grayish white; iris brown; bill dark olivaceous-brown; feet dull yellow.

Description of immature bird (Cat. No. 243504, U.S.N.M.; collected at Dire Daoua, Abyssinia, Dec. 6, 1911).—Paler throughout than

¹ Proc. U. S. Nat. Mus., vol. 28, July 8, 1905, pp. 845-847.

adult; feathers of occiput gray at base, edged with brown, thus restricting the pure gray to the anterior portion of the crown; feathers of back, scapulars, and wing-coverts edged with pale rusty or pure white; sides of head, chin, and upper throat nearly white; chest light vinaceous-drab; abdomen ecru-drab.

Measurements of type (adult male).—Length of skin, 195; wing, 110; tail, 79; culmen (chord), 15; tarsus, 19.

Average measurements of four adult males.—Wing, 108; tail, 80.6; culmen (chord), 14.25; tarsus, 18.8.

Average measurements of two adult females.—Wing, 104.8; tail, 77; culmen (chord), 14.7; tarsus, 18.5.

Material.—Seven specimens from Dire Daoua and the Hawash River, Abyssinia, collected by the Childs Frick African Expedition.

CHALCOPELIA CHALCOSPILA MEDIA, new subspecies.

GATO METALLIC-SPOTTED DOVE.

Type-specimen.—Adult male, Cat. No. 243515, U.S.N.M.; collected near the south end of South Lake Abaya, near Gardulla and the Gato River camp of the Childs Frick African Expedition, in Abyssinia, March 28, 1912, by Edgar A. Mearns. (Original number, 20885.)

Characters.—Most closely related to *Chalcopelia chalcospila intensa*, described above, from which it differs in being paler throughout and in having more bluish purple in the wing-spots.

Description of adult male and female.—Crown gray (deep gull gray), paling to grayish white on forehead and sides of head; upper side of neck, and mantle, grayish drab; wing-coverts and inner secondaries paler drab; exposed portion of bastard wing black, concealed portion kaiser brown; some of the inner median wing-coverts and some of the scapulars, with golden-green and bluish purple spots; across the lower back are two broad black bands and between them one of pale grayish buff; upper tail-coverts light drab, each feather broadly edged with black at tip; central rectrices light drab, becoming black apically, the outer ones gray at base and broadly black terminally, the three outermost narrowly tipped with pale drab or pale gray; under side of tail black, with apical edging of pale gray to about three outer feathers and pale gray outer web to outer feather; under tail-coverts black mesially, considerably mixed with white laterally; chin pinkish white; lower throat, chest, and upper abdomen, light brownish vinaceous, passing into grayish white on lower abdomen; iris, brown; bill, dark vinaceous-brown; feet dull yellow.

Measurements of type (adult male).—Length of skin, 180; wing, 106; tail, 78; culmen (chord), 13.5; tarsus, 18.

Average measurements of seven adult males.—Wing, 108; tail, 79; culmen (chord), 14; tarsus, 18.8.

Average measurements of six adult females.—Wing, 104; tail, 74.1; culmen (chord), 14.2; tarsus, 18.3.

Material.—Thirteen adults from the south end of the Abaya lakes southward to Bodessa on the middle portion of the Sagan River, north of Lake Rudolf, all in southern Abyssinia.

CINNYRIS VENUSTA BLICKI, new subspecies.

BLICK'S BUFF-BREASTED SUNBIRD.

Type-specimen.—Adult male, Cat. No. 217964, U.S.N.M.; collected near the south shore of Lake Stefanie, in northern British East Africa, May 17, 1912, by J. C. Blick.

Characters.—Most closely related to *Cinnyris venusta albiventris* and *C. v. falkensteini*, differing from these in being smaller (see measurements below); and it also differs from *albiventris* in having a wash of pale yellow over the lower chest and upper abdomen posterior to the metallic violet of the lower throat, these parts being pure white in *albiventris*, which has the pectoral tufts orange-rufous instead of orange-chrome; from *falkensteini* it is readily distinguished by its white sides and crissum and the very pale yellow of the lower chest and upper abdomen.

Description of adult male.—Forehead, crown, lores, chin, and throat metallic cyanine blue, changing on lower throat and upper chest to hyacinth blue; side of head behind eye, upper side of neck, mantle, lesser upper wing-coverts, back, and rump metallic green largely mixed with violet-blue feathers; upper tail-coverts metallic dusky greenish blue; greater wing-coverts and quills dark brown, faintly edged externally with whitish olive; pectoral tufts orange-chrome anteriorly, lemon yellow posteriorly; tail dark blue; under parts, posterior to the dark throat, white washed with very pale yellow except on sides and crissum; thighs black; iris dark brown; bill, feet, and claws black.

Description of adult female.—Upper parts drab, becoming black on upper tail-coverts; tail blackish blue, its outer feather externally edged with pale gray; superciliary stripe soiled white; under parts white, in some specimens slightly grayish on the chin and throat, and always washed with a scarcely discernible tint of yellow; iris dark brown; bill purplish black, paler at base of mandible; feet and claws plumbeous-black.

Measurements of type (adult male).—Length of skin, 96; wing, 52; tail, 39; culmen (chord), 16; tarsus, 16.

Average measurements of six adult males of Cinnyris venusta blicki.—Wing, 52.7; tail, 36; culmen (chord), 16; tarsus, 16.

Average measurements of six adult females of Cinnyris venusta blicki.—Wing, 49; tail, 38.5; culmen (chord), 15.5; tarsus, 15.5.

Average measurements of adult males of Cinnyris venusta albiventris.—Length of skin, 110; wing, 57; tail, 42; culmen, (chord), 16; tarsus, 17.

Average measurements of adult males of Cinnyris venusta falkensteini.—Length of skin, 105; wing, 53; tail, 37.5; culmen (chord), 18; tarsus, 15.5.

Average measurements of adult males of Cinnyris venusta fazoqlensis.—Length of skin, 105; wing, 54; tail, 42.5; culmen (chord), 16; tarsus, 15.

Remarks.—The fifteen specimens on which this subspecies is based show no approach to *Cinnyris venusta fazoqlensis*, the form *blicki* being interposed between *C. v. albiventris* and *C. v. falkensteini*, and ranging from Gardulla, in southern Abyssinia, south to the Nyiro and Indunumara mountains, in British East Africa.

CINNYRIS MEDIOCRIS GARGUENSIS, new subspecies.

MOUNT GARGUES DOUBLE-COLLARED SUNBIRD.

Type-specimen.—Adult male, Cat. No. 217754, U.S.N.M.; collected at the summit of Mount Gargues (altitude 7,100 feet), north of the Guaso Nyiro River, in British East Africa, August 27, 1911, by Edmund Heller. (Original number, 249.)

Characters.—Males with under parts paler than in *Cinnyris mediocris keniensis* or *C. m. mediocris*; smaller than *keniensis*; about the size of *mediocris* from Mount Kilimanjaro; female much grayer than the above forms.

Description of adult male.—Head, neck, lesser wing-coverts, mantle, back, and rump golden-green; upper tail-coverts metallic violet-blue; wings dark brown, greater wing-coverts and quills narrowly edged with citrine-drab; tail bluish black; chest-collar coral red, separated from the green throat by a narrow collar of metallic blue; pectoral tufts citron yellow; under parts, posterior to the red pectoral band, light olive-gray; under wing-coverts and inner portion of quills grayish white.

Description of adult female topotype.—Upper parts deep olive-gray; tail blue-black, with two outer rectrices narrowly edged with white; chin and throat mouse gray, washed with olive; remaining under parts pale buffy brown.

Measurements of type (adult male).—Length of skin, 100; wing, 53; tail, 40; culmen (chord), 17.5; tarsus, 17.5.

Average measurements of three adult male topotypes.—Wing, 53.7; tail, 41; culmen (chord), 17.1; tarsus, 17.5.

Measurements of female topotype.—Wing, 52; tail, 40; culmen (chord), 17.5; tarsus, 17.¹

¹ For measurements of *Cinnyris mediocris mediocris* and *C. m. keniensis* see Smithsonian Miscellaneous Collections, vol. 56, No. 14, Dec. 23, 1910, p. 4.

Geographical range.—Known only from Mount Gargues, British East Africa.

CINNYRIS REICHENOWI KIKUYENSIS, new subspecies.

KIKUYU DOUBLE-COLLARED SUNBIRD.

Type-specimen.—Adult male, Cat. No. 246001, U.S.N.M.; collected at Escarpment Station (altitude 7,390 feet) on the Uganda Railway in the Kikuyu Mountains, British East Africa, September 6, 1912, by Edgar A. Mearns. (Original number, 24076.)

Characters.—Smaller than *Cinnyris reichenowi reichenowi* Sharpe from Sotik, northeast of Victoria Nyanza,¹ and more grayish, less ochraceous, on the under parts posterior to the red pectoral collar.

Description of adult male.—Head, neck, mantle, lesser wing-coverts, and back metallic golden-green; upper tail-coverts, and a narrow collar separating the green of the throat from the red chest, metallic blue-violet; greater wing-coverts and quills dark brown, the feathers externally edged with dark citrine; tail blue-black; chest broadly banded with nopal red (20 millimeters in width); posterior under parts dark olive-gray anteriorly, changing to citrine-drab on crissum; pectoral tufts lemon yellow; under wing-coverts neutral gray; inner border of quills pale neutral gray; iris dark brown; bill, feet, and claws black.

Comparative measurements of males.

Name.	Length of skin.	Wing.	Tail.	Culmen (chord).	Tarsus.
<i>Cinnyris reichenowi reichenowi</i> , from original description.....	102	53.3	35.6	16.5	16.5
<i>Cinnyris reichenowi reichenowi</i> , from Reichenow's Vogel Afrikas, vol. 3, 1905, p. 491.....	110-115	51-53	36-40	15-16	16-17
<i>Cinnyris reichenowi reichenowi</i> , from Mount Ruwenzori.....	112	54	42	15	16
<i>Cinnyris ansorgei</i> , from original description.....	-----	53	40	¹ 18.3	20
<i>Cinnyris reichenowi kikuyensis</i> , type.....	95	53	40	13	15

¹ Reichenow, Vogel Afrikas, vol. 3, 1905, p. 491, states that this is an error, and that the culmen measures 15 millimeters.

CHALCOMITRA SENEGALENSIS ATRA, new subspecies.

BLACK SCARLET-BREASTED SUNBIRD.

Type-specimen.—Adult male, Cat. No. 246077, U.S.N.M.; collected on the Thika River, at Camp No. 2 of the Childs Frick African Expedition, 20 miles above its junction with the Tana River, in British East Africa, August 27, 1912, by Edgar A. Mearns. (Original number, 23912.)

Characters.—The blackest form of the *Chalcomitra senegalensis* group. Most closely related to *Chalcomitra senegalensis æquatorialis* (Reichenow) from Victoria Nyanza, from which it differs in being

¹ *Cinnyris ansorgei* Hartert, from Nandi Station, is considered to be a synonym of *C. r. reichenowi*.

slightly smaller and very much darker in color; larger and darker than *C. s. acik* or *C. s. senegalensis*; no metallic colors on wings, back, or upper tail-coverts; female darker, less yellowish brown than in other forms of *senegalensis*.

Description of adult male.—Forehead and crown metallic green, sometimes bluish; chin and upper throat metallic golden-green; mustachial band bluish green; sides of head, occiput, upper side of neck, and mantle black, becoming slightly brownish on lower back, rump, and upper tail-coverts; wings and tail blackish mummy brown; lower throat and chest nopal red, with a narrow subterminal metallic blue bar to each feather; abdomen, sides, under wing-coverts, flanks, thighs, and under tail-coverts jet black; iris very dark brown; bill feet, and claws black.

Description of adult female.—Upper parts dark hair brown; lores and ear-coverts chaetura black; upper wing-coverts edged externally with white; mustachial band yellowish white, the feathers chaetura black at base; chin, throat, and breast chaetura drab, the feathers narrowly edged with pale yellowish olive; abdomen hair brown, much obscured by yellowish edging to the feathers; sides and flanks light grayish olive, the feathers edged with whitish; under wing-coverts olive-buff, with dark bases to the feathers; under tail-coverts pale olive-gray, with dark bases to the feathers; iris dark brown; bill, feet, and claws black.

Four immature males, in which the red-and-blue pectoral band is appearing, have the feathers of the under parts broadly bordered with pale olive-yellow. In all ages and both sexes this form is darker than any other form of the *senegalensis* group.

Measurements of type (adult male).—Length of skin, 132; wing, 74; tail, 52.5; culmen (chord), 28.5; tarsus, 17.5.

Average measurements of two adult males (including the type).—Wing, 75; tail, 52; culmen (chord), 28.7; tarsus, 17.2.

Average measurements of two adult females.—Wing, 67.5; tail, 44.2; culmen (chord), 27; tarsus, 16.5.

Geographical range.—Upper Tana and Thika rivers, and Tharaka District between the Tana and Guaso Nyiro rivers, in British East Africa.

ANTHREPTES COLLARIS GARGUENSIS, new subspecies.

MOUNT GARGUES COLLARED SUNBIRD.

Type-specimen.—Adult male, Cat. No. 217750, U.S.N.M.; collected on Mount Gargues, at 7,100 feet, British East Africa, August 25, 1911, by Edmund Heller. (Original number, 244.)

Characters.—Most closely related to *Anthreptes collaris zambesiana* and *A. c. hypodila*. From the former it differs in being slightly larger, darker (less golden) green above, and more olivaceous yellow below;

from *hypodila* (type from Fernando Po) it differs in being much larger, of a slightly paler shade of green above, and lemon yellow instead of lemon chrome below.

Description of adult male.—Head, neck, mantle, back, rump, and lesser wing-coverts metallic green with a slight golden luster; wings dark brown, with quills bordered externally with citrine; rectrices deep blue edged with metallic green; under parts lemon yellow, washed with olive on sides; pectoral tufts pure lemon yellow; a collar of metallic violet separates the green throat from the yellow under parts; edge of wing pale yellow; under wing-coverts yellowish white; iris brown; bill, feet, and claws black.

Description of adult female.—Above similar to adult male; below lacking the metallic green chin and throat and the metallic violet collar, the entire under parts being olive-yellow, darkest on the chest, sides, and crissum and yellowest on the abdomen.

Description of young male in first plumage.—Yellower on under parts than adult female, with darker olive throat and upper chest.

Measurements of type (adult male).—Length of skin, 103; wing, 55; tail, 39; culmen (chord), 15; tarsus, 16.

Average measurements of five adult males (including the type).—Wing, 53.8; tail, 39; culmen (chord), 14.4; tarsus, 15.8.

Measurements of adult female (Cat. No. 245979, U.S.N.M.; from Meru Forest, British East Africa).—Wing, 52; tail, 34; culmen (chord), 14; tarsus, 15.

*Average measurements of two adult males of *Anthreptes collaris hypodila* from West Africa*.—Wing, 49; tail, 35; culmen (chord), 13.3; tarsus, 15.

*Average measurements of two adult females of *Anthreptes collaris hypodila* from West Africa*.—Wing, 46.5; tail, 32.5; culmen (chord), 12.8; tarsus, 14.3.¹

Remarks.—Specimens from the upper Athi River (Juja Farm) are intermediate between *zambesiana* and *garguensis*; those from around Mount Kenia are more olivaceous on the under parts than any others.

Geographical distribution.—Upper Athi River, Mount Kenia region, and Mount Gargues, in British East Africa.

ESTRILDA ATRICAPILLA KENIENSIS, new subspecies.

MOUNT KENIA BLACK-CROWNED WAXBILL.

Type-specimen.—Adult male, Cat. No. 214622, U.S.N.M.; collected at Fey's Farm, altitude 8,000 feet, in the Aberdare Mountains, near Mount Kenia and Lake Naivasha, British East Africa, August 11, 1909, by Edgar A. Mearns. (Original number, 16540.)

Characters.—Most closely related to *Estrilda atricapilla graueri* Neumann from Mount Sabjingo, Western Kivu Volcanoes, Central

¹ For measurements of *Anthreptes collaris zambesiana* and *A. c. elachior*, see Smithsonian Miscellaneous Collections, vol. 56, No. 14, Dec. 23, 1910, p. 5.

Africa, but slightly smaller, with throat and sides of head grayish instead of being white. From *Estrilda atricapilla atricapilla* Verreaux, from Camaroon and Gaboon, it differs in being considerably paler below, with the mantle brownish instead of grayish and much less heavily cross-banded with black; and the black of the head includes the eye.

Description of adult male and female.—Top of head, including lores and orbital region, black; mantle grayish brown, finely and somewhat obscurely cross-banded with black; rump and upper tail-coverts pompeian red; wings brownish slate with outer wing-coverts and inner secondaries cross-banded with black; tail slaty black, very obscurely cross-banded with black; chest and upper abdomen neutral gray, gradually deepening to black on lower abdomen and crissum, and paling to pale neutral gray on throat and sides of head; sides and flanks pompeian red; axillars, under wing-coverts, and inner border of quills grayish white; bill, feet, and claws entirely black.

Measurements of type (adult male).—Length of skin, 100; wing, 46; tail, 48; culmen (chord), 8.5; tarsus, 15.

Average measurements of two adult males (including the type).—Wing, 46; tail, 48; culmen (chord), 8.5; tarsus, 15.

Average measurements of two adult females.—Wing, 44; tail, 45.5; culmen (chord), 8.5; tarsus, 15.

Geographical range.—Aberdare and Kenia mountains, 8,000 to 8,500 feet, in British East Africa.

Remarks.—The range of *Estrilda nonnula* Hartlaub, described from Kudurma, almost meets that of *E. a. keniensis* in western British East Africa, having been collected by Mr. Edmund Heller at Kaimosi, 25 miles northeast of Kisumu.

HALCYON SENEGALENSIS CINEREICAPILLUS, new subspecies.

UPPER NILE KINGFISHER.

Type-specimen.—Adult male, Cat. No. 216577, U.S.N.M.; collected at Kisingo, between Kutwi and Kigomma, Uganda, Africa, December 29, 1909, by Edgar A. Mearns. (Original number, 17859.)

Characters.—Most closely related to *Halcyon senegalensis senegalensis* (Linnæus) and *H. s. fuscopileus* Reichenow, the former from Senegal, the latter from Jaunde and Bipindi, in the Kamerun District. It differs from *senegalensis* in being slightly larger, with paler (more ashen) crown, and more whitish under parts; and from *fuscopileus* it differs in the much paler blue of the upper parts, the much paler and less brownish pileum, the paler and more finely vermiculated under parts, and also in its larger size.

Description of type (adult male).—Upper side of head and neck light neutral gray, sometimes washed with pale blue; lores and a narrow ring around the eye black; a white superciliary band begins

behind the nostril, encircling the eye to the black lores, and blending outwardly into the grayish color of the top and sides of the head; exposed portion of wing-quills, mantle, back, rump, and upper tail-coverts cendre blue, slightly palest on the rump and upper tail-coverts; upper wing-coverts and tips of quills black, inner webs of wing-quills white at base; exposed portion of tail-feathers italian blue above; under side, and concealed outer edge of upper side of rectrices black; chin, upper throat, and crissum white; remainder of under parts grayish white, very finely and abundantly vermiculated with gray, and sometimes faintly washed with blue on chest and sides of head and neck; iris very dark brown; upper mandible vermilion, sometimes dusky at tip; lower mandible entirely jet black, or, occasionally, with a streak of orange on its side; feet purplish black; claws, black.

Measurements of type (adult male).—Length of skin, 218; wing, 106; tail, 69; culmen (chord), 48; tarsus, 14.5.

Average measurements of four adult males (type included).—Wing, 106; tail, 68; culmen (chord), 46.5; tarsus, 14.6.

Average measurements of three adult females.—Wing, 105.2; tail, 68.7; culmen (chord), 46.7; tarsus, 13.

Geographical distribution.—Lakes Victoria and Albert, and the Upper White Nile (Bahr el Jebel).

Remarks.—The forms of *Halcyon senegalensis* quite closely resemble *Halcyon cyanoleucus* (Vieillot), but may be readily distinguished by the absence of a black band extending through and *behind* the eye.

HALCYON MALIMBICUS PRENTICEI, new subspecies.

LAKE VICTORIA ASH-FRONTED KINGFISHER.

Type-specimen.—Adult [male?], Cat. No. 217407, U.S.N.M.; collected on the Sesse Islands, in Lake Victoria, Uganda, East Africa, by Father Prentice, of the French Mission, Uganda. Not sexed by the collector, but, from its large size, supposed to be a male.

Characters.—Most closely related to *Halcyon malimbicus malimbicus* (Shaw) from West Africa, from which it differs in being slightly larger, with the blue parts of the plumage purer and paler, and the under parts pure white.

Description of type (and only specimen).—Head above deep bluish gray-green, tinged with brown around base of maxilla; a narrow line of white extends from the base of the bill at nostril over the eye; a broad band of black extends backwards from the bill, surrounding the eye, and extending posteriorly over the ear-coverts nearly to the back of the head; chin and throat pure white; sides of head, neck all round, upper chest, and edge of wing bremen blue; back from nape to rump Nile blue; scapulars and wing-coverts jet black; quills black, the inner web white at base, the basal half of the external web of the primaries, and nearly the entire outer web of the secondaries capri

blue; tail, china blue above, black below; entire under parts pure white, with a black spot on under wing-coverts at base of primaries; bill with maxilla peach red, becoming dusky brown at apex and on sides of basal half, and with mandible jet black; feet, in dry skin, blackish brown.

Measurements of type.—Wing, 112; tail, 74; culmen (chord), 54; tarsus, 17.

Measurements of adult male of Halcyon malimbicus malimbicus (Shaw) from Efulen, Kamerun, West Africa (Cat. No. 159986, U. S. Nat. Mus.).—Wing, 106; tail, 74; culmen (chord), 53; tarsus, 15.5.

Remarks.—This subspecies most closely resembles a Cameroon specimen of *malimbicus*, and is not closely related to the forms *forbesi* and *torquatus* from northwest Africa—Cameroons to Senegambia.¹

MELITTOPHAGUS VARIEGATUS LORINGI, new subspecies.

NYANZA BEE-EATER.

Type-specimen.—Adult male, Cat. No. 216565, U.S.N.M.; collected at Butiaba, Lake Albert, Uganda, Africa, January 6, 1910, by J. Alden Loring. (Original number, 674.)

Characters.—Most closely related to *Melittophagus variegatus variegatus* (Vieillot), but larger and much paler and purer yellow on the under parts.

Description of type (adult male).—Upper side of head and neck, mantle, back, rump, and upper tail-coverts calla green; outer wing-coverts and scapulars calla green; primaries yellowish oil green with subterminal blackish spots and orange-citrine bases to the inner webs; secondaries ochraceous-tawny at base, subterminally broadly banded with black, and narrowly tipped with pale gray; elongated innermost secondaries green, marked with turquoise-blue apically; tail with middle pair of feathers cedar green, becoming bluish on distal portion, and tipped with pale gray, the remaining rectrices ochraceous-buff tinged with green on outer webs, broadly black subterminally, and narrowly tipped with grayish white; a narrow eyebrow pale cerulean blue; eyelid beryl blue; a broad black band passes through and behind the eye; chin and throat light cadmium, below which is a double collar of antwerp blue anteriorly and hessian brown posteriorly; abdomen, sides, flanks, thighs, and crissum olive-ocher; edge of wing honey yellow; axillars, lining of wings, and bases of quills cinnamon-buff. Iris red; bill and feet black.

Measurements of type (adult male).—Wing, 89; tail, 69; culmen (chord), 35; tarsus, 11.

Measurements of one adult of Melittophagus variegatus variegatus (Vieillot) from West Africa.—Wing, 84; tail, 66; culmen (chord), 28; tarsus, 9.

¹ Oberholser, Proc. U. S. Nat. Mus., vol. 22, No. 1180, p. 12, 1899.

COLIUS STRIATUS JEBELENSIS, new subspecies.

RIVER JEBEL COLY.

Type-specimen.—Adult male, Cat. No. 216489, U.S.N.M.; collected at Gondokoro, Uganda, Africa, February 23, 1910, by J. Alden Loring. (Original number, 868.)

Characters.—Of the twelve accepted races of *Colius striatus* Gmelin the subspecies *jebelensis* is much more closely related to the subspecies *berlepschi* (Hartert) than to any of the others. It differs only in its smaller size, barred instead of plain nape and upper mantle, paler and browner coloration above, and more rufescent (less olivaceous) under parts.

Description of adult male and female.—Orbital region and lores black, very finely dotted with grayish white; forehead black; crown and crest light drab-gray; cheeks and ear-coverts silky grayish white; upper side of neck, mantle, and outer surface of wings grayish drab, the nape and upper mantle, only, finely and faintly cross-banded with darker; back and upper tail-coverts drab; upper surface of tail benzo brown; chin and throat blackish, each feather with a small grayish-white spot; sides of neck and sides of upper chest grayish brown, very finely cross-banded with dusky; chest, sides, abdomen, and crissum buckthorn brown; under surface of tail buffy citrine, shafts pale yellow except at tip, which is brown.

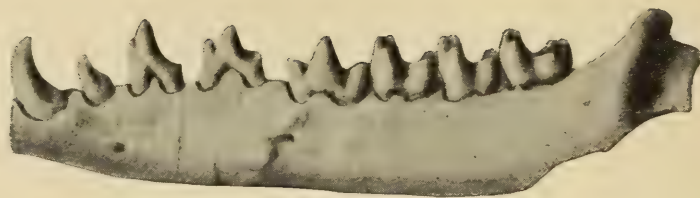
Measurements of type (adult male).—Length of skin, 285; wing, 94; tail, 194; culmen (chord), 13; tarsus, 21.5.

Average measurements of ten adult males.—Wing, 93.2; tail, 204.3; culmen (chord), 12.9; tarsus, 21.

Average measurements of six adult females.—Wing, 93.5; tail, 206.3; culmen (chord), 13.2; tarsus, 21.4.

Geographical range.—Upper Nile (Bahr el Jebel) from Gondokoro to Lake Albert and eastward across Uganda to Lake Victoria.

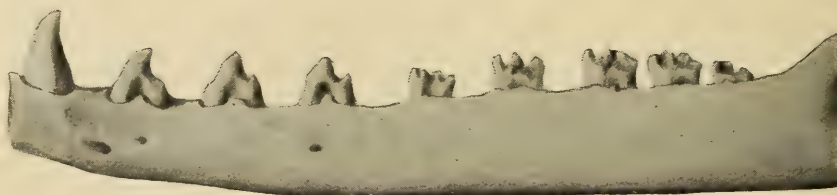
Remarks.—There is little possibility of mistaking this mousebird for any of the three forms from northeastern Africa, as Von Zedlitz has given excellent colored figures of *Colius striatus leucotis*, *C. s. erlangeri*, and *C. s. hilgerti*, in the *Journal für Ornithologie* for 1910, plate 10. *Colius striatus affinis* Shelley has been restricted to the coast region of East Africa from German East Africa to Southern Somaliland. From *Colius striatus berlepschi* Hartert, which occupies the interior equatorial region from Mount Kilimanjaro and New Heligoland west to Victoria Nyanza, it is readily distinguishable by its smaller size; and *berlepschi* from nearly all of its range may be known by the absence of cross-bars from the upper side of the neck and upper mantle.



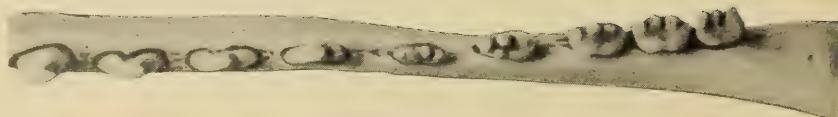
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JAWS OF MYRMECOBOIDES AND MYRMECOBIUS.

FOR EXPLANATION OF PLATE SEE PAGE 395.

AN EXTINCT MARSUPIAL FROM THE FORT UNION WITH NOTES ON THE MYRMECOBIDAE AND OTHER FAMILIES OF THIS GROUP.

By JAMES WILLIAMS GIDLEY,

Assistant Curator of Fossil Mammals, United States National Museum.

In a small lot of Fort Union mammals recently collected by Mr. A. C. Silberling in Sweet Grass County, Montana, there is a lower jaw which, though small in size, is of great importance, since it apparently represents an unexpectedly early appearance of a possible relative of the Myrmecobidae a family of marsupials hitherto known only from a single living genus, *Myrmecobius*. The description given below is followed by a brief discussion of the peculiar features of the species, its possible affinities, and some short notes on the probable derivation of the marsupials in general.

MYRMECOBOIDES, new genus.¹

This genus, represented by a single species of small size, may be distinguished as follows: Canine semipremolariform, being irregularly triangular in cross section and but slightly curved; canine and the three simple premolars evenly spaced with short intervening diastemae. There is also a short diastema between the canine and i_3 (the position of the other incisors is not known). Fourth tooth behind the canine (probably dp_4 retained) completely molariform; true molars tritubercular, with well-developed basin heel, but with inner cusps of trigonid (paraconid and metaconid) as high or higher than main outer cusp (protoconid).

Ordinal affinities of this genus marsupialian, and it is probably related to the *Myrmecobidae*.

MYRMECOBOIDES MONTANENSIS, new species.

PLATE 23.

Type-specimen.—(Cat. No. 8037, U.S.N.M.). A left lower jaw carrying a series of 8 teeth, c to m_3 . Collected by A. C. Silberling.

Type-locality and horizon.—Sweet Grass County, Montana, "Gidley Quarry," about the middle of the Fort Union deposits of that locality.

¹ This name is given to the ancient form on account of its likeness to *Myrmecobius* rather than as a positive assumption of real relationship.

Description.—Dental formula: $i_{\overline{2}}, c_{\overline{1}}, pm_{\overline{3}}, dp_{\overline{1}}, m_{\overline{3}}$. Jaw relatively long and slender; length of tooth series, including canine and m_3 , 20 mm.; depth of jaw at c , 2.5 mm.; at m_2 , 3.7 mm. P_1 single rooted but compressed laterally and with small posterior heel; p_2 and p_3 with anterior cusp budding off from the main cusp and a posterior basal cusp (p_3 is somewhat larger and has slightly more prominent accessory cusp than p_2); dp_4 completely molariform with the metaconid and protoconid subequal in size, but otherwise differing from the true molars in the somewhat narrower and smaller heel and in the position and relatively larger size of the paraconid which is a well-developed, anteriorly directed cusp quite distinct from the metaconid. All the molars have low, basin-like heels with relatively high inner cusps and high trigonids in which the metaconids and paraconids are closely appressed, forming a column which exceeds the protoconid in height and equals it in bulk. The paraconid, though close to the metaconid, is quite distinct at the summit. The entoconid is an irregularly rounded and pointed cusp showing on the inner side a tendency to split into two cuspules.

Possible affinities and comparison with Myrmecobius.—The little Fort Union mammal jaw described above presents some interesting features. While these can not be interpreted with absolute finality, or with more than a limited degree of certainty, because of the great time interval between the Paleocene and the present day, and the absence of known intermediate forms, the specimen nevertheless strongly suggests relationship to the Myrmecobidae, as now represented by the single living species *Myrmecobius fasciatus*. Making due allowance for its more primitive condition, this lower jaw, aside from its fewer teeth, resembles that of *Myrmecobius* in a marked degree. The special points of resemblance (see plate 23) are these: (1) The jaw is elongated anterior to the four molariform teeth and has a well-marked but short diastema between each of the premolars, the first premolar and the canine, and the canine and last incisor. The jaw is broken at the latter point and none of the incisors is preserved, but enough remains to show (2) that the jaw extended straight forward from the canine and probably carried spaced incisors as in *Myrmecobius*. (3) The canine is laterally compressed and semi-premolariform, and the manner in which it is set into the jaw also resembles a premolar. (4) Premolars 2 and 3 are narrow transversely and long at the base, with well-developed anterior cusps budding out from the main cusps, high above their bases, as in *Myrmecobius*; p_1 is small and single rooted, though laterally compressed like the others. (5) All the teeth are entirely without cingula. (6) The inner main cusps (metaconid and entoconid) of the molars are apparently developing toward conate forms, while they equal or exceed the two

main outer cusps (protoconid and hypoconid, respectively) in height. The relatively small size of the latter, and especially the protoconid, which is apparently diminishing, is a modification toward the condition reached in *Myrmecobius*, and away from the usual development of primitive tri-tuberculate teeth. In fact, all these characters denote progressive development away from the type characteristic of the primitive insectivores, carnivores, and creodonts, and toward *Myrmecobius*.

A point of difference is the very close approximation of the paraconid to the metaconid. Although quite distinct at the summit, the paraconid forms a part of the elevated metaconid column. In *Myrmecobius* this cusp is usually distinct and directed forward but as pointed out by Dr. B. Arthur Bensley¹ in his valuable contribution on The Evolution of the Australian Marsupialia, the dentition in the living genus is exceedingly variable in detail. One of the two specimens in the U. S. National Museum collection shows a much closer approximation to *Myrmecoboides* in this respect than does the other; hence it is possible that the more anterior position of the paraconid in *Myrmecobius* may have been secondarily acquired as a result of the extreme lengthening of the jaw. Another point of difference between the living and the extinct forms is the relatively greater elevation and better definition of the trigonid in the latter. This, however, is doubtless due to its more primitive condition.

The first molariform tooth in *Myrmecoboides montanensis*, which stands in the position of p_4 , is worthy of special notice. It differs in some important features from those behind it, but is so typically and completely molariform as to suggest a true molar or more probably a tooth of the deciduous series. However, it is not possible to say in the absence of proof whether it may not be after all a highly specialized molariform premolar. Its very complex structure in contrast with p_3 , which is a simple, unspecialized tooth, is against this supposition and strengthens the view that it is more probably a retained milk molar. Special features of the tooth itself favor this conclusion and seem to preclude the other alternative of considering it also a true molar. It has the same number of cusps as the molars, and these, with the exception of the paraconid, have the same general form, proportions, and arrangement. The crown is proportionally narrower, the talonid is relatively smaller, and the large paraconid is directed well forward, making up the whole anterior portion of the trigonid, and is quite distinct. In this respect this tooth differs markedly from the true molars.

It thus appears that in this specimen we have real evidence confirming the view held by Winge and supported by Lydekker, Bensley, and others that the first molariform tooth in all the marsupials is a

¹ Trans. Linn. Soc. London, ser. 2, Zool., vol. 9, pt. 3, 1903, p. 102.

fourth milk molar which is never replaced by a premolar as in the placentals. The development of a fourth molariform tooth and the loss of a premolar, however accomplished, must be considered one of the earliest specializations of the marsupials since this reverse tooth formula is characteristic of the entire group.

An apparent objection to considering the Fort Union species as in any way related to the ancestral line which gave rise to *Myrmecobius* is the fact that it possesses only the normal number of post-canine teeth, namely, seven, while *Myrmecobius* has eight or frequently nine in the lower jaw. The importance of this difference however, depends entirely on the source of the supernumerary teeth in *Myrmecobius*. If this characteristic is an ancient survival resulting from the derivation of *Myrmecobius* from some one of the Jurassic mammal-like forms having more than the normal number of post-canine teeth, as suggested by Owen, Thomas, Leche, and others, then such a form as *Myrmecoboides* could not be placed in the line of descent. But if, on the other hand, as seems more probable, the increase in number of teeth in *Myrmecobius* came about secondarily through the permanent retention of deciduous premolars, as suggested by Winge, there is nothing inconsistent in considering the Montana species an ancestral relative of the later genus. A significant point in this connection is the fact that in the *M. montanensis* jaw the longest diastema is between p_3 and dp_4 .

ADDITIONAL NOTES ON THE ORIGIN OF MYRMECOBIUS.

There is in our present knowledge nothing to support Owen's hypothesis regarding the derivation of *Myrmecobius*. On the other hand, as has been pointed out especially by Bensley,¹ there is considerable evidence for, and a reasonableness in assuming that this genus has, like the other marsupials, descended from an ancestral form with a normal primitive marsupial dentition. In consequence of its ant-eating habits, resulting in the modification of the entire series as well as the great lengthening of the jaws anteriorly, the condition was acquired whereby a second and finally a third additional tooth of the remaining milk series were retained permanently, in the manner suggested by Winge.

The dental characters of the genus *Myrmecobius* have been very fully described and discussed and the literature on the subject reviewed by Bensley. Hence it is not necessary to enter into much detail here. A few additional points suggest themselves, however, and some of those advanced by Bensley and others are seemingly somewhat altered by a restudy of the lower jaw of *Myrmecobius*, when comparing it with the Montana specimen. While not entirely disregarding the theory advanced by Winge, Bensley

¹ Trans. Linn. Soc. London, ser. 2, Zool., vol. 9, pt. 3, 1903, p. 102.

seems rather to favor the view that the excessive number of molars in *Myrmecobius* is due to "a simple reduplication of teeth from the posterior portion of the dental lamina," the minute size of the molars and the great lengthening of the jaws offering just the conditions favorable for an intercalation of new teeth. In defense of this he observes that "even assuming a retention of the deciduous teeth, we would still have to account for the occasional presence of an additional lower molar."¹ The application of this observation, however, is not clear, since, beginning with the normal marsupial dental series, viz., p_3, dp_1, m_3 , it requires but the addition of two more permanently retained deciduous molars to equal the greatest number of post-canine teeth found in this species, namely, 9, making the dental formula for the lower jaw as follows: $i_3, c_1, p_3, dp_3, m_{2 \text{ or } 3}$. This would still leave two teeth less than the normal combined number of the milk and permanent series of post-canine teeth found in both the marsupials and placentals, the missing ones being dp_1 of the first series, probably very early shed or never replaced, and p_4 of the permanent premolar series, either early absorbed or never developed. The variability in the molar series in *Myrmecobius* seems due to the presence or absence of the last molar, probably a disappearing tooth. In the upper jaw the last molar seems to be normally wanting, while the second is apparently in the process of disappearing, being sometimes present and sometimes wanting. There is also an occasional variation in the number of milk molars retained, the upper jaw of a specimen in the United States National Museum collection having two such teeth on one side and only one on the other.

However regarded, the teeth of *Myrmecobius*, as pointed out by Bensley, show every indication that the genus was derived from a primitive form with normal tritubercular teeth of the general insectivorous type. The present specialization is toward a pseudotricodont type, evidently acquired through the peculiar development of the inner and the atrophy of the outer cusps of the lower molars, with a similar but reverse modification of the upper molars, with the addition to the series of supernumerary teeth accomplished through the retention of milk molars. Conceding this to be the true history of the development of *Myrmecobius*, the little lower jaw from the Fort Union formation, whether considered ancestrally related or not, is morphologically intermediate in nearly every particular between such a jaw as that of *Myrmecobius* and those of the generalized primitive types of trituberculate mammals. It stands nearer to the tritubercular form, it is true, but is nevertheless intermediate in development,

¹ Trans. Linn. Soc. London, ser. 2, Zool., vol. 9, pt. 3, 1903, p. 100.

and if regarded as ancestral furnishes very good evidence against the earlier supposition that *Myrmecobius* is a direct and little-changed descendant of some one of the Jurassic mammal-like forms having more than the normal number of teeth. It is indeed very doubtful whether the latter gave rise to any of the higher mammals, and such forms as *Dryolestes*, *Dicrocynodon*, *Tinodon*, etc., of the Jurassic, with their many post-canine teeth, were probably not marsupials at all. A recent restudy of these ancient forms leads me to believe that there are good reasons for regarding them rather as monotremes, and in this group may possibly be found the early representatives of the living members of this strange order of mammals.

In considering the derivation of the marsupials and placentals it must not be overlooked that regardless of the origin of the fourth molariform tooth in the marsupials the normal number of post-canine teeth of primitive or generalized forms in both groups is invariably seven, any deviation from this number being due to a loss or addition through specialization. The obvious inference, then, is that the common ancestral forms from which these great groups were originally derived had a like normal dental formula. Such a genus, therefore, as *Triconodon*, or some other form having four premolariform and three molariform teeth behind the canine, would be a more logical Jurassic ancestral type for the higher mammals than would such forms as *Dryolestes*, *Dicrocynodon*, etc., which have many more than the normal number of both premolariform and molariform teeth. The ultimate origin of these great groups is, however, at best largely speculative with our present knowledge.

NOTES ON THE ORIGIN OF THE MARSUPIALS.

From expressing disbelief in Owen's hypothesis regarding the origin of *Myrmecobius*, Bensley seems to have gone to the other extreme in suggesting the derivation of all the living marsupials from an Oligocene form (*Peratherium*) of the Didelphidae. Osborn¹ seems to have adopted this view also, while Gregory² in his recent contribution on The Orders of Mammals, seemingly accepts Bensley's views in general but gives much greater antiquity to the ancestral stock of the marsupials. I can not regard Bensley's view as wholly tenable, even if the didelphid prototype were carried to a much more remote time than the Oligocene. If the Fort Union mammal here described, whether directly ancestral or not, is in any way related to the living *Myrmecobius*, we have evidence that the Myrmecobidae had at least reached a marked degree of specialization which separated this family distinctly from the other marsupials at a much earlier date than is assumed by Bensley for the differentiation of the whole order. Even

¹ Evolution of the mammalian molar teeth. Biol. Studies and Addresses, vol. 1, 1907, p. 109.

² Orders of Mammals. Bull. Amer. Mus. Nat. Hist., vol. 27, 1910, p. 229.

at this early period (Paleocene) there is no evidence of a close similarity to a didelphid type of dentition, nor is there a suggestion of any particularly close affinity to the dasyurids, which are considered by Bensley to be direct derivatives of the early didelphids, as represented by *Peratherium*. It is obvious that if the Myrmecobidae had a beginning so very much earlier, as is indicated by the Fort Union specimen, so likewise must the Dasyuridae and probably all (certainly some) of the other living families of marsupials.

This conclusion also is not in accordance with the view expressed by Osborn¹ regarding the origin of marsupials of Australia, which he suggests were derived from the "introduction into Australia of some small arboreal opossum of *Didelphys*-like form as the source of the wonderful adaptive radiation of the marsupials of this continent." The fossil evidence at present available, as I interpret it, does not apparently support either Osborn's or Bensley's view concerning the origin of the modern families of marsupials, nor in reality does it give more than a small part of the life history of this great order of mammals. In fact, it seems reasonable to assume that at present nothing is definitely known regarding the ancestry of several of the living marsupial families, including probably all the diprotodonts,² because they are not represented in our collections from beds older than the Pleistocene, and that in the known fossils we have only an incomplete and indefinite history of the origin and development of a part only of the polyprotodonts. Thus it seems from the paleontological evidence we are at present not justified in assuming more than that the Didelphidae only are represented in such forms as *Peratherium* (Oligocene), *Proteodidelphus* (Paleocene?), and possibly *Didelphops* of the Lance formation. The Myrmecobidae are presumably represented by *Myrmecoboides* of the Fort Union (Paleocene), while *Dasyurus* and possibly the Peramelidae may have been derived with the Didelphidae from differing forms of the *Didelphops* (Lance) group. The Thylacinidae and Caenolestidae are apparently not known from fossils older than the Miocene where they had reached almost their present state of specialization.

Such a view, I am aware, assumes a vastly more ancient origin for all the living families of marsupials than has hitherto been held for them while it must be conceded that the greater part of their evolutionary development remains practically unknown.

In the early attempts of vertebrate paleontologists to read the life-history of the globe as recorded by the fossil animal remains, it appears to have been too often assumed that the known fossils of a few widely scattered localities told the greater part of the whole story of the

¹ The Age of Mammals, 1910, p. 78.

² The Caenolestidae have been placed in this great group apparently on the diprotodont-like development of the lower jaw. However, this may be an entirely independently acquired character. This family more probably belongs with the Polyprotodonts.

origin and development of the great groups of animals which have inhabited the earth, sufficient account not having been taken of the great number of chapters which are as yet unsupplied by the discoveries of collectors. Thus, in the genus *Phenacodus* from the Wasatch, Cope at one time believed he had discovered a generalized type from which had originated all the Perissodactyls. It is now known, however, that this great group probably had a very much earlier beginning, and it was not derived, at least, from any of the known condylarths. This is one of numerous instances in which too broad or sometimes obviously false generalizations have been made by investigators in their search among the incomplete fossil records for ancestral forms, and in their attempts at working out lines of descent. Even to-day a strong tendency toward this method of reasoning seems to prevail among paleontologists. It is usually assumed, in a general way, that the earliest-discovered recognizable representatives of a group indicate the actual first appearance of that group among the faunas of the earth, and the absence of fossil remains of a group in the known collections is usually treated as indicating its nonexistence. Such assumptions, while in great part excusable perhaps, have nevertheless resulted in the assigning of a much too recent date for the origin and differentiation of most, if not all, of the living orders and families of mammals, and doubtless have caused much of the confusion and disagreement that now exists among authorities in working out correlations and phyletic lines of descent. Many instances might be given in which recent discoveries have corrected errors of this kind, the tendency being to carry periods of origin further and further back in time. Thus, group after group when studied in the light of our increased knowledge is seen to have a much earlier beginning than was assigned it a few years ago. The archaic aspect of the Paleocene fauna is frequently spoken of, but such specimens as the one here described, and others of similar character from the Fort Union beds, make it seem probable that the very ancient appearance of the known faunas of the Paleocene may be attributed in a marked degree to the fact that our collections are representative of limited facies and do not happen to contain many forms, doubtless living elsewhere at the time, which if present would give a far more modern aspect to the fauna of this age. The known Paleocene faunas are from relatively small areas, and these of a comparatively uniform environment (probably in greater part forest and swamp); hence it may well be that the greater number of the then existing ancestors of living groups are yet unknown.

REPTILES OF NORTHWESTERN NEVADA AND ADJACENT TERRITORY.

By C. H. RICHARDSON,

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INTRODUCTION.

The Lahontan Basin occupies the bed of the quaternary Lake Lahontan and its drainage system which lies principally within northwestern Nevada, although ramifications of it extend into eastern California and southern Oregon. This extensive drainage area includes a number of river systems of which the Truckee, the Humboldt, the Walker, and the Honey Lake, are the largest. A unique feature of the topography is the rather large number of "sinks" or lakes without outlets; the Truckee system has two, Pyramid Lake and Winnemucca Lake, and is also remarkable in that it finds its source in the alpine Lake Tahoe. The Humboldt system loses its waters in Humboldt Lake, the Carson system in North and South Carson Lakes, the Walker system empties into the Walker Lake, and the Susan River and Long Valley Creek systems terminate in the fluctuating Honey Lake.

The Lahontan Basin is marked by a succession of mountain ranges and level plains. The predominating plant growth over the greater part of this region is the "sage brush," *Artemisia tridentata*, which in some places excludes nearly all of the other forms. Along streams the cottonwood, *Populus fremontii*, and willows form the most conspicuous vegetation, while on the mountains, the juniper, *Juniperus utahensis*, grows abundantly. The flora of the desert immediately south of Pyramid and Winnemucca Lakes is of a different character, *Sarcobatus* and other shrubs largely replacing the "sage brush." This difference in the flora is correlated with a greater diversity in the reptilian fauna, and we find such southern forms as *Callisaurus* and *Sceloporus magister*.

The present report is based largely upon a collection obtained by Prof. J. O. Snyder, of Stanford University, and the writer, while pursuing ichthyological investigations for the United States Bureau of Fisheries. The expedition remained in the field from May 23 until July 17, 1911. During that time collections and observations were made at Truckee, Nevada County; Tahoe City, Placer County; Tallac, Eldorado County; Susanville and Doyle, Lassen County, California,

and in Nevada at Reno, Derby, Wadsworth, vicinity of Pyramid Lake Indian Agency, Washoe County; Carson City, Ormsby County; Winnemucca, Humboldt County; Palisade, Eureka County; and Deeth, Elko County. There are also included notes on certain specimens in the Stanford University collection not heretofore published, and for completeness all available published records have been added. All measurements are given in millimeters.

The greater part of this work was done in the zoological laboratory of Stanford University, and I am indebted to Prof. J. O. Snyder, of that institution, for many helpful suggestions. I am also under obligations to Dr. L. Stejneger, Dr. John Van Denburgh, Dr. J. Grinnell, and Prof. M. Herrick Spaulding, for the loan of specimens.

GEOGRAPHICAL VARIATION IN CERTAIN WEST AMERICAN REPTILES.

During the course of work upon this collection, a number of tangible differences between both the northern and southern and mountain and plain forms of certain species have been found. In the case of *Callisaurus ventralis* and *Uta stansburiana*, large series of specimens have been available and a decision has been reached regarding their status; specimens of other forms have not been so numerous and I have chosen merely to indicate the differences in the material examined. The following table shows the divergence in the species of both series:

Species showing differences correlated with latitude.

SOUTHERN FORM.	NORTHERN FORM.
<i>Callisaurus ventralis</i> .	<i>C. ventralis myurus</i> .
(Southeastern California and southern Arizona.)	(Pyramid Lake, Nevada.)
Length greater (ratio body to tail 0.728).	Length less (ratio 0.807).
Femoral pores more (average 16.6).	Femoral pores less (average 14.2).
Color lighter.	Color darker.
<i>Uta stansburiana elegans</i> .	<i>Uta stansburiana</i> .
(Desert of southeastern California, Arizona, New Mexico, and Mexico.)	(Northern Nevada, Oregon, Idaho, and Utah.)
Size larger { Tail length averages—male, 98.3 mm., female, 76.2 mm.	Size smaller { Tail length averages—male, 74+ mm.; female, 67+ mm.
Ratio hind leg to length from snout to anus, averages—male 0.741, female, 0.699.	Ratios—male, 0.714; female, 0.649.
Femoral pores more (average 14+).	Femoral pores less (average 13+).
Dorsal scales fewer, larger and keeled (average, 86.5).	Dorsal scales more, smaller and smooth (average 103.4).
<i>Sceloporus magister</i> .	<i>Sceloporus magister</i> .
(Fort Lowell and Tempe, Arizona.)	(Pyramid Lake, Nevada.)
Size larger { Snout to anus, average, male, 113.2 mm.	Size smaller { Snout to anus, average, male, 94 mm.
Tail length, average, male, 150.2 mm.	Tail length, average, male, 124.4 mm.
Femoral pores more (average 13+).	Femoral pores less (average 11+).

<i>Phrynosoma douglassii hernandesi.</i>		<i>Ph. douglassii hernandesi.</i>	
(Arizona and New Mexico.)		(Deeth, Nevada.)	
Size larger	Total length, average, male	Size smaller	Total length, average, female
	108.8 mm. ¹		103.4 mm.
	Hind leg, length, average, male 40.6 mm.		Hind leg, length, average, female 37.9 mm.

Species showing differences correlated with altitude.

PLAIN INHABITING FORM.		MOUNTAIN INHABITING FORM.	
<i>Sceloporus graciosus.</i>		<i>Sceloporus graciosus.</i>	
(Deeth, Nevada.)		(Lake Tahoe, California.)	
Size larger	Tail length, average, male,	Size smaller	Tail length, average, male,
	71.9 mm.		63.3 mm.
Femoral pores more (average 15+).		Femoral pores less (average 12+).	
Color lighter.		Color darker.	
<i>Thamnophis ordinoides elegans.</i>		<i>Thamnophis ordinoides elegans.</i>	
(Palisade, Nevada.)		(Lake Tahoe, California.)	
Size larger	Total length, average, male,	Size smaller	Total length, average, male,
	520 mm.		409.8 mm.
	Tail length, average, male,		Tail length, average, male,
	132.5 mm.		103.8 mm.
Dorsal scale formula larger (21-19-17 appearing most frequently).		Dorsal scale formula smaller (19-21-19-17 appearing most frequently).	
Color lighter.		Color darker.	

I have not placed in this table the form *Uta stansburiana hesperis*, which differs from *U. s. elegans* in having small scales and from *U. stansburiana* in the possession of distinctly keeled scales. It inhabits the upper Sonoran zone of the comparatively cool coastal belt of Southern California, and its range is continuous with that of the more truly lower Sonoran zone form, *elegans*. It is interesting to note that here, as in the northern species, *stansburiana*, small dorsals scales are correlated with a cool habitat.

It is evident from the data here presented that *Callisaurus ventralis*, *Uta stansburiana*, *Sceloporus magister*, and *Phrynosoma douglassii hernandesi* are smaller in the northern part of their range than in the southern and that reduction in size in the first three species is correlated with a reduction in the number of femoral pores. Unfortunately, femoral pore counts were not made on the specimens of *Phrynosoma* from southern localities, but Ruthven (1907) gives 15 to 16 as the usual number, about the same as the average for the Deeth specimens. Likewise a comparison of the *Sceloporus graciosus* from Lake Tahoe, California (altitude 6,225 feet), with those from Deeth, Nevada (altitude 5,342 feet), shows that the former is smaller and possesses a lesser number of femoral pores. Specimens of *Thamnophis ordinoides elegans* from Lake Tahoe, California, are smaller in size and have a reduced number of dorsal scales, while specimens taken at

¹ Adult males are usually smaller than adult females.

Palisade, Nevada, at a lower altitude (4845 feet) are larger and have an increased number of dorsal scales. Ruthven (1908), in his admirable paper, *Variations and Genetic Relationships of the Garter-Snakes*, has shown quite conclusively the northward dwarfing of the species in the genus *Thamnophis*, both in regard to scale characters and size of body. It would appear that this latitudinal variation is not restricted to any one genus or family of American reptiles, but occurs alike in both the saurians and the serpents. Whether the altitudinal variations are as widespread or as marked must be decided by future studies.

It is not within the scope of this work to consider the factors which have caused the variations indicated. That is a problem for the experimentalist. Undoubtedly important results await the student who will test the inheritance of squamation and size under artificial environments in which the temperature, humidity, and food supply can be controlled.

CROTAPHYTUS COLLARIS BAILEYI (Stejneger).

Locality.—Six specimens of this form were taken near the Pyramid Lake Indian Agency, and four at Derby, Nevada. There is also a male in the Stanford University collection from the Palmetto Mountains, Esmeralda County, Nevada. It has been previously recorded in the Lahontan Basin at Big Creek Ranch, Pine Forest Mountains, and from the Truckee River, Nevada.

Status and variation.—The above-mentioned specimens have two rows of interocular scales and small supraoculars, characteristic of this subspecies, an average of 11 rows of the latter across the greatest width of the supraocular region. Concerning the interocular scales, it might be well to state that there are in the Stanford University collection two specimens, a male from Bisbee, Cochise County, Arizona, and a female from Cedar Ranch, Colorado Canyon, Arizona, each of which has a single-fused interocular. Meek (1905, p. 8) mentions a specimen from Winslow, Arizona, showing a like variation, and it would seem that such variants were of quite frequent occurrence in this region. All the Nevada and California individuals which I have seen, however, have a double series of interoculars.

The average number of femoral pores in 10 individuals is 17, the extremes 15 and 19.

The six males in the series have the anterior part of the double black collar continuous ventrally and a black patch on either side of the belly extending from the middle of the trunk across the inguinal region to a point one-third the distance down the posterior surface of the thigh. A single specimen from Esmeralda County, Nevada, and three others from Lytle Creek, San Bernardino County, California, in the Stanford University collection, are of this same type of coloration. The specimens from Arizona and New Mexico, which were compared

with these, lacked the continuous black collar and black patches on the belly.

The females are lighter ventrally than the males. In preserved specimens, the markings on the throat and sides of head are very faint, the belly is white suffused with blue-gray and the anterior black collar is wanting below.

Habits.—This lizard was found only on hillsides among deposits of tufa and outcroppings of volcanic rock at an elevation of 4,500 feet.

CROTAPHYTUS WISLIZENII Baird and Girard.

Locality.—The collection contains 13 specimens from the Pyramid Lake Indian agency, 3 from The Willows, Pryamid Lake, 1 from Derby, 4 from Carson City, Nevada, and 2 from Doyle, Lassen County, California. Other points in the basin where it is known to occur are Truckee River and Wadsworth, Washoe County; Amos, Quinn River Crossing, Pine Forest Mountains, and Thousand Creek Flat, Humboldt County, Nevada.

Status and variation.—I can see no difference between this series and specimens of *Crotaphytus wislizenii* from southern Idaho and San Diego County, Cal. The width of the head, in the material examined, seldom exceeds the distance from the nostril to the ear opening, and the distance from the nostril to the inner orbital angle is nearly always as great or greater than the vertical diameter of the ear opening. These features will readily distinguish the specimens in question from the nearly related *Crotaphytus silus* Stejneger. The measurements of 11 specimens are appended:

	Six males.	Five females.
Greatest width of head:		
Minimum.....	15	16
Average.....	18.1	18.9
Maximum.....	20.5	22
Nostril to ear:		
Minimum.....	16	16
Average.....	18.2	18.6
Maximum.....	21.5	22.5
Nostril to inner orbital angle:		
Minimum.....	4.5	4.5
Average.....	5.2	5.6
Maximum.....	6	7
Vertical diameter of ear:		
Minimum.....	3	4
Average.....	4.2	4.9
Maximum.....	5	5.5
Length, snout to anus:		
Minimum.....	75	77
Average.....	87	93.6
Maximum.....	104	115
Length of tail:		
Minimum.....	153.5	153
Average.....	175.2	183.5
Maximum.....	{ 13 200 }	217
Femoral pores:		
Minimum.....	19	
Average.....	21+	
Maximum.....	25	

¹ Indicating number of individuals from which measurements were taken.

Habits.—*Crotaphytus wislizenii* was found on the desert among low growths of *Artemisia tridentata* and other shrubs. Its food consisted to some extent of other lizards, for a whole *Cnemidophorus tigris*, the tail of another, and a *Uta stansburiana* were found in the stomachs examined.

Two females taken at the Pyramid Lake Indian Agency between May 26 and June 1 contained two and four eggs, respectively. One secured at Derby on June 29 carried two well-developed eggs, and another taken at Carson City on July 10 contained large eggs and had assumed the brilliant red-orange breeding colors.

CALLISAURUS VENTRALIS MYURUS, new subspecies.

Diagnosis.—Resembles *Callisaurus ventralis* (Hallowell), to which it is closely allied, but has a higher ratio between body and tail length, fewer femoral pores, and averages darker in dorsal coloration.

Type-specimen.—No. 51786 U.S.N.M. From Pyramid Lake Indian Agency, Washoe County, Nevada, June 2, 1911. Collectors, J. O. Snyder and C. H. Richardson.

Description of type.—Head about as long as wide, covered with small flat or slightly rounded plates of which the interparietal is the largest; nostrils surrounded by a series of small plates, smallest on the posterior margin; plates of prefrontal region larger than those to either side of it; supraocular regions 8 scales wide, separated by a single row of scales smaller than those of adjoining prefrontal region; anterior superciliary largest, followed by 4 scales on one side of the head and 5 on the other; eyelids fringed with small scales, those on the lower lid larger and more acutely pointed than those on the upper; supralabials imbricate and prominent; infralabials smaller than supralabials, flat and not imbricate; a row of scales below infralabials separated by two shorter rows posteriorly; gular granules larger than anterior dorsals, imbricate and largest on posterior gular fold. Dorsum covered with slightly rounded granules, gradually increasing in size from head to base of tail and decreasing laterally from the median dorsal region; number of dorsal granules in a head length posterior from interparietal plate, 47; anterior from a point on dorsum opposite anus, 39; scales on tail imbricate, keeled dorsally for the greater part of the distal four-fifths of its length; several rows of weakly spinose scales occupy the distal four-fifths of its lateral margins. Femoral pores 14 and 15.

Color in alcohol: Snout olive, gradually blending into dark blue-gray on dorsum. Dorsum spotted with white; on its median region are two parallel rows of dull black spots which gradually increase in size and intensity from the head to the base of the tail, where they

fuse to form cross bars. Tail lighter, with a greater admixture of white. Fore legs lightly suffused with blue-gray; hind legs barred and mottled with darker markings, with three definite bars on each tibia. Posterior surface of each femur with one blue-gray bar extending across it longitudinally. Throat white, mottled with gray; gular patch with a slight purple tinge. Belly and ventral surface of legs, white; on each side of belly a long blue patch, crossed obliquely by two triangular-shaped black bars, the posterior one largest. Tail, underneath, white with three black spots near the base and five black bands occupying a more distal position and forming complete annuli.

	mm.
Length of head.....	13
Width of head.....	14
Fore leg.....	39.5
Hind leg.....	71
Base of fifth to end of fourth toe.....	33
Length, snout to anus.....	76.5
Length of tail.....	92
Ratio, length of body to tail .831	

The *Callisaurus* from the vicinity of Pyramid Lake, Nevada, presents some well marked deviations from the typical *Callisaurus ventralis* (Hallowell) which entitle it to a name. These differences involve the ratio between the length of body (from snout to anus) and tail, the number of femoral pores and the dorsal coloration. The average ratio of body to tail in 45 individuals picked at random from a large series compared with the same ratio in 30 specimens of typical *C. ventralis* (22 from Yuma, Arizona, 6 from Fish Springs, and 2 from Oak Grove, San Diego County, California), shows that this character is very distinct. In *Callisaurus v. myurus*, the ratios range from 0.727 to 0.864 with an average of 0.807, while in *Callisaurus ventralis* the range is from 0.678 to 0.826, the average 0.728. Females of both forms are smaller than the males, but the ratios are the same. The following table shows the variation of femoral pores in a number of series. It will be seen that the range of variation and the average number of femoral pores in the Nevada series are lower than in any other except the one from Fairbank and Fort Lowell, Arizona, in which the range of variation is smaller. The femoral pore counts for the series from Tucson, Arizona, are taken from Ruthven (1907, pp. 518-523). In this series as in the series from Fairbank and Fort Lowell, Arizona, the average number of pores on each thigh is greater than in the others.

Variation in the femoral pores of Callisaurus ventralis and C. v. myurus.

Locality.	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Average.
<i>Callisaurus v. myurus</i> , new species, Pyramid Lake Indian Agency, Washoe County, Nevada, 53 specimens.....	5	21	35	34	8	3	.....	.....	.....	.....	.....	.....	.....	.....	14.2
<i>Callisaurus ventralis</i> (Hallowell), vicinity of Fish Springs, San Diego County, California, 27 specimens.....	2	5	3	10	14	8	7	3	2	.....	.....	.....	.....	.....	16
<i>Callisaurus ventralis</i> (Hallowell), Yuma, Arizona, 25 specimens.....	.....	4	3	8	9	7	5	1	.....	.....	.....	.....	.....	.....	15.8
<i>Callisaurus ventralis</i> (Hallowell), Tucson, Arizona, 54 specimens (Ruthven).....	.....	1	4	6	20	22	30	11	5	5	1	.....	3	.....	17.6
<i>Callisaurus ventralis</i> (Hallowell), Fairbank, Cochise County, and Fort Lowell, Pima County, Arizona, 14 specimens.....	.....	.....	.....	.....	9	7	7	.....	2	.....	.....	.....	.....	.....	17.1

The dorsal color is deep blue-gray in contrast to the ashy-gray or even lighter shade of *C. ventralis*. In large specimens the color approaches that of the darker individuals of *C. ventralis*. Unfortunately the dorsal color was not recorded in fresh specimens, but comparison of the alcoholic material from Nevada with specimens of a similar nature from San Diego County, California, Yuma, Fairbank, and Fort Lowell, Arizona, shows that it is a darker form. Dr. C. Hart Merriam (Stejneger, 1893, p. 172) mentions a *Callisaurus* from Death Valley, California, which, he says, is "much shorter and broader (than *C. ventralis*), with a shorter tail, and is bluish-gray in color." He thinks this is the same form which inhabits the region about Pyramid Lake, Nevada, and from his description this appears to be true. Three specimens in the Stanford University collection from Owen's Valley, a locality a little to the north of Death Valley, have the characteristic dorsal color of *myurus*. Unfortunately, they are mutilated beyond hope of obtaining accurate measurements. The femoral pores in two of them are 14-14 and 14-16.

A study of the ventral color pattern of the males of *myurus* was undertaken to find, if possible, any variation toward the three bar pattern of *Callisaurus draconoides* Blainville. In 33 males but one variant was discovered, this individual having two black bars and a small black spot on one side of the belly, while the other side possessed two complete bars, the normal number.

The adult female of *myurus* is colored essentially like the male, but the blue patch on the belly is absent, the black bars are faintly outlined and the gray gular patch is lacking. A salmon-red spot may or may not be present on the throat.

The color of the young male is as follows: In general like adult female except for heavier markings on the throat and absence of a

salmon-red spot on the gular region. The blue ventral patch characteristic of the adult male is entirely lacking and the black triangular-shaped bars are merely suggested. The latter are, however, more pronounced than in the adult female. The dorsal black markings are heavier than in the adult male or female. The color of the young female is like that of the adult female, except for the presence of darker markings on the dorsal surface and the absence of the salmon-red gular spot.

Locality.—*Callisaurus v. myurus* was collected at the Pyramid Lake Indian Agency, along the southwestern shore of Pyramid Lake as far as The Willows, and at Derby and Wadsworth, on the Truckee River. It has been recorded before in the Lahontan Basin from the vicinity of Pyramid Lake.

Cope (1883, p. 18) states that he saw a species of *Holbrookia* "north of Pyramid Lake, but it was so swift that I did not succeed in catching a specimen." He collected in this region "during the hot weather of July, 1882," and probably mistook the abundant *Callisaurus* for it. At least it seems fair to take this view, since no specimens of the closely allied genus *Holbrookia* were obtained by Cope at the time, and his observation has not been corroborated.

Habits.—In our experience this lizard was the most conspicuous and the most abundant saurian in the localities mentioned. It occurred in greatest numbers on the sandy desert among low-growing shrubs. It was never seen in the denser growths of *Artemisia tridentata* or on rocky hillsides. Like *Callisaurus ventralis*, it is very fleet of foot, often running a hundred feet or more when frightened. It seldom runs straight ahead of the intruder, but describes an arc to the right or left. When in rapid motion, the tail was observed raised considerably above the level of the body, but never "curled up over the back," as has been described for *C. ventralis* (Stejneger, 1893, p. 171). Several times the tail was seen curled over the back, but always when the lizard was moving very slowly. During a light thunder shower many of these lizards buried themselves in the loose desert sand, where they remained until almost trodden on before showing themselves.

An individual wounded by Professor Snyder uttered a high-pitched cry when handled, which, he says, was very suggestive of the note of certain Hawaiian geckos.

Examination of 7 stomachs indicated that the food of *myurus* consisted of both animal and vegetable matter, the latter absent from only 2 stomachs. The vegetable content usually consisted of bits of green leaves, although small purple flowers were found in 1 stomach. The identified insects were wasps and grasshoppers. Some spiders were also found, and larvae of many kinds were present.

Three females dissected on May 31 at the Pyramid Lake Indian Agency contained 4, 5, and 6 large eggs each.

UTA STANSBURIANA Baird and Girard.

Locality.—There are 19 individuals of this species from the Pyramid Lake Indian Agency and 4 from Derby, Nevada. Other localities in the basin where it has been observed before are: Virginia City, Storey County; Pine Forest Mountains and Virgin Valley, Humboldt County; Quinn River Crossing and Amos, Humboldt County; and Cortez and River Ranges, near Carlin, Nevada.

Status and variation.—A study of the specimens of this lizard from the Lahontan Basin has led me into a rather detailed investigation of *Uta stansburiana*, resulting in the discovery of one new subspecies and the resurrection of an old name for another. This species has a wide distribution, and it is not surprising that a number of distinct geographical races exist.

Uta stansburiana was described by Baird and Girard (1852, p. 69) from specimens collected in the Valley of the Great Salt Lake, Utah. The original description, very brief and general, has been of little value in the present work, and as specimens from the type locality have not been available for comparison it has been necessary for me to use specimens from adjacent territory. Material from the following places has been examined:

Number of specimens.	Locality.	Source.
1	Fillmore, Utah.....	United States National Museum.
6	Snake River, Lincoln County, Idaho.....	Stanford University collection.
2	Quinn River Crossing, Humboldt County, Nevada.....	University of California, Museum of Vertebrate Zoology.
10	Pine Forest Mountains, near Big Creek Ranch, Humboldt County, Nevada.	Do.
2	Pine Forest Mountains, mouth of Alder Creek, Humboldt County, Nevada.	Do.
12	Virgin Valley, Humboldt County, Nevada.....	Do.
4	Derby, Washoe County, Nevada.....	Stanford University collection.
19	Pyramid Lake Indian Agency, Washoe County, Nevada.....	Do.
3	Vicinity Abert Lake, Lake County, Oregon.....	Do.
1	Near Summer Lake, Lake County, Oregon.....	Do.
1	Round Valley, Inyo County, California.....	Do.
2	Near Lone Pine, Inyo County, California.....	Do.

Uta stansburiana Baird and Girard is characterized by small, rounded, and weekly carinated dorsal scales. The number of scales in a line from the interparietal plate to a point on the rump above the posterior surfaces of the thighs varies between 89 and 116. The average for 55 specimens is 103.4. The table on page 418 shows the

maximum, minimum, and average measurements and scale counts in a number of individuals. Tail length is not included, since most of the specimens have broken or regenerated tails. Six males have a tail length ranging from 70 mm. to 77 mm., average $74 + \text{mm.}$ In five females the minimum length is 66 mm., the maximum 69 mm., and the average $67 + \text{mm.}$ The femoral pores likewise are fewer in number (average $13 +$) than in the other forms considered below.

Recently Doctor Ruthven (1913) has described a new form of this genus, *Uta stansburiana nevadensis*, from the Cortez Range, west of Carlin, Nevada. The distinctive characters which he mentions are color, the small size of the dorsal scales, and reduced number of femoral pores. The peculiar spotted type of coloration described by him—that is, the dorsum, with the ground color broken by small spots of blue and faintly indicated black spots—is abundantly represented in my series from Snake River, Idaho, Quinn River Crossing, Pine Forest Mountains, Virgin Valley, Derby, Pyramid Lake Indian Agency, Nevada, and Abert Lake, and Summer Lake, Oregon. In this same series there are many individuals which do not possess this type of coloration. On the other hand, there are many specimens of *Uta stansburiana elegans* in the Colorado River series which are the exact counterparts of the spotted type found in Nevada, Oregon, and Idaho, except that the ground color is slightly lighter. In regard to the other characters, size of dorsal scales, and number of femoral pores, it is apparent that *nevadensis* is identical with *stansburiana*, as I have here defined it. *Nevadensis* has small, weakly-keeled dorsal scales (25 to 30 in a head length), and the femoral pores average 13.6. Although I have not seen specimens from the type locality of *Uta stansburiana*, I have had at my command a good series from adjacent territory which was reasonably uniform in color and squamation. Therefore, until a good series of specimens from the exact type-locality is available and can be shown to differ from the *Uta* of eastern Nevada, it seems advisable to retain the name *stansburiana* for the form here defined.

UTA STANSBURIANA ELEGANS (Yarrow).

Locality.—Specimens of the small scaled *Uta* from the desert regions of southern California, Arizona, New Mexico, Texas, and parts of Mexico, represent a new form, to which is here given the old name *elegans*. *Uta elegans*, described by Yarrow (1882a) from specimens sent from La Paz, Lower California, Mexico, has for some time been considered synonymous with *Uta stansburiana* in that it was based upon color characters which proved to be inconstant. However, there are structural differences which readily distinguish this southern form from the typical *stansburiana*.

For the definition of *Uta stansburiana elegans* a large array of specimens, representing many localities, has been used. They are as follows:

No. of specimens.	Locality.	Source.
CALIFORNIA.		
22	Near Needles, Colorado River.....	University of California Museum of Vertebrate Zoology.
5	5 miles below Needles, Colorado River.....	Do.
5	8 miles east of Picacho, Colorado River.....	Do.
7	20 miles above Picacho, Colorado River.....	Do.
6	Chemehuevis Valley, Colorado River.....	Do.
6	Pilot Knob, Colorado River.....	Do.
8	Riverside Mountain, Colorado River.....	Do.
3	Blythe, Colorado River.....	Do.
20	Opposite Cibola, Colorado River.....	Do.
3	Near Salton Lake, Imperial County.....	Do.
4	Fort Yuma.....	Stanford University collection.
2	Salt Creek, Imperial County.....	University of California Museum of Vertebrate Zoology.
1	Cane Spring, Imperial County.....	Do.
1	Vallecito, San Diego County.....	Do.
1	Mountain Spring, San Diego County.....	Do.
2	Carrizo Creek, San Diego County.....	Do.
4	La Puerta, San Diego County.....	Do.
1	Indio, Riverside County.....	Stanford University collection.
7	Mohave, Kern County.....	Do.
1	Bakersfield, Kern County.....	Do.
2	Victorville, San Bernardino County.....	Do.
1	Los Banos, Merced County.....	Do.
1	Bear Valley, San Benito County.....	Do.
3	White River, Tulare County.....	Do.
1	Fresno, Fresno County.....	Do.
ARIZONA.		
2	Near the Needles, Colorado River.....	University of California Museum of Vertebrate Zoology.
8	Above Bill Williams River, Colorado River.....	Do.
7	Ehrenberg, Colorado River.....	Do.
25	10 miles below Cibola, Colorado River.....	Do.
6	5 miles north of Laguna, Colorado River.....	Do.
6	Yuma.....	Stanford University collection.
13	Tempe.....	Do.
5	Fort Lowell, Pima County.....	Do.
NEW MEXICO.		
4	Near Grant, Valencia County.....	Stanford University collection.
2	Rio Puerco, Valencia County.....	Do.
34	Albuquerque.....	Do.
TEXAS.		
1	El Paso.....	United States National Museum.
MEXICO.		
1	La Paz, Lower California (type-locality).....	United States National Museum.
3	San Jose del Cabo, Lower California.....	Stanford University collection.
1	Chihuahua.....	United States National Museum.

Description.—Like *Uta stansburiana* Baird and Girard, but with larger and more heavily carinated and acutely pointed dorsal scales. The number of scales in a line from the interparietal plate on the head to a point on the back above the posterior surfaces of the thighs varies in 111 specimens from 78 to 103; average, 86.5. (See table, p. 418.) The general size is larger than that of *Uta stansburiana*, especially in the ratio of the hind leg to the length from snout to anus (see table, p. 418) and in the tail length. The tail length in 6 males from the Colorado River, Arizona and California, ranges from 92.5 mm. to 104.5 mm.; average, 98.3 mm. In 8 females from the same region the minimum length is 71.5 mm., the maximum 81.5 mm., the average 76.2 mm.; longer than in any typical *Uta stansburiana* examined. The femoral pores average 14+ on each thigh, a larger average number than is possessed by *Uta stansburiana*.

Occasional specimens from localities along the Colorado River, California and Arizona, have small, rather weakly-keeled dorsal scales, which in this respect resemble true *Uta stansburiana*. In the coast region of southern California and probably also in the western part of the San Joaquin Valley, California, *elegans* freely intergrades with another form, which will here be described.

UTA STANSBURIANA HESPERIS, new subspecies.

Diagnosis.—Resembles *Uta stansburiana elegans* (Yarrow) in size of body and in the character of the squamation, but the dorsal scales are smaller.

Type.—Male, No. 892, University of California Museum of Vertebrate Zoology. From Arroyo Seco Canyon, near Pasadena, Los Angeles County, California, August 3, 1903. Collector, J. Grinnell.

Description of type.—Head from snout to posterior border of interparietal plate slightly longer than wide; nostrils separated by five small plates; there are four large supraoculars completely surrounded by smaller scales, those on the outer margin largest; the interparietal is the largest of the plates on the head and exceeds the four supraoculars in dimensions; a long, keeled subocular on each side, followed posteriorly by two smaller ones; ear denticulations of 3 pointed scales, the uppermost largest, separated from an anterior group of enlarged granules by two rows of smaller ones. Dorsum covered with small imbricate scales, largest along the median region and decreasing rather abruptly laterally; for about one head length back of the interparietal plate the dorsals are small, rounded, and unkeeled, then they become larger, keeled, and weakly spinose, gradually increasing in size till they blend quite insensibly into the large, strongly keeled,

mucronate caudal scales. There are about 114 scales in a line from the posterior edge of the interparietal plate to a point above the posterior surfaces of the thighs. Dorsal and anterior surfaces of fore legs covered with keeled, imbricate scales, larger than those on the rump. Scales on the dorsal and anterior surfaces of hind legs keeled, imbricate, and larger than those on the fore legs; their posterior surfaces are covered with granules. Scales on throat flat; 36 in a straight line from the symphyseal to the gular fold, inclusive. Gular fold fringed with 17 bluntly pointed scales which are larger than the gulars. Belly scales smooth, 69 in a line from the gular fold to the anus. The ventral surfaces of the legs are covered with smooth scales. Ventral surface of tail clothed with smooth, bluntly pointed scales, which are smaller than those on the dorsal surface of the tail. Femoral pores 15 and 16. Color (in alcohol): Head gray brown. Dorsum darker, with parallel rows of dark-brown blotches. Dorsal surface of forelegs dark gray, spotted with lighter gray; hind legs of a lighter color. A black post-axilla spot on each side. Throat blue, spotted with white. Belly white.

Measurements of type, male.

	mm.
Length of head (to posterior edge of interparietal plate).....	11
Greatest width of head.....	9.5
Length, snout to anus.....	51
Length of tail (regenerated).....	58
Fore leg.....	21.5
Hind leg.....	38.5
Longest toe from base of fifth to tip of fourth, including claw.....	17

Status.—The form *hesperis* blends completely into *elegans* along the Coast Range, in Riverside and San Diego Counties, and in the northwestern part of Lower California, Mexico. In San Diego County almost typical *elegans* has been found at Pine Mountain near Escondido and at La Puerta. The one specimen from Gorman Station, on the edge of the Mohave desert, has 93 dorsal scales, and it seems probable that *hesperis* intergrades with *elegans* in that region also. The table on page 418 shows the range of variation in this subspecies.

Specimens belonging to this form have been examined from the localities listed below:

No. of speci- men.	Locality.	Source.
SANTA BARBARA COUNTY, CALIFORNIA.		
2	Friars Harbor, Santa Cruz Island.....	University of California Mu- seum of Vertebrate Zool- ogy.
VENTURA COUNTY, CALIFORNIA.		
3	Ana Capa Island.....	University of California Mu- seum of Vertebrate Zool- ogy.
1	Mount Pinos.....	Do.
LOS ANGELES COUNTY, CALIFORNIA.		
10	Vicinity of Pasadena (type-locality).....	University of California Mu- seum of Vertebrate Zool- ogy.
2	Near San Fernando.....	Do.
1	Tejunga Valley.....	Do.
1	Gorman Station, Antelope Valley.....	Do.
1	San Pedro.....	Stanford University collec- tion.
20	Santa Catalina Island.....	California Academy of Sci- ence.
3	San Clemente Island.....	University of California Mu- seum of Vertebrate Zool- ogy.
SAN BERNARDINO COUNTY, CALIFORNIA.		
11	Ontario.....	Stanford University collec- tion.
4	Cajon Wash, San Bernardino.....	University of California Mu- seum of Vertebrate Zool- ogy.
2	Santa Ana Canyon, San Bernardino Moutains.....	Do.
1	Fish Creek, San Bernardino Mountains.....	Do.
4	Reche Canyon, near Colton.....	Do.
RIVERSIDE COUNTY, CALIFORNIA.		
7	Snow Creek, San Jacinto Mountains.....	University of California Mu- seum of Vertebrate Zool- ogy.
15	Vicinity of Schains Ranch, San Jacinto Mountains.....	Do.
5	Near Cabazon.....	Do.
1	Palm Canyon, San Jacinto Mountains.....	Do.
1	Strawberry Valley, San Jacinto Mountains.....	Do.
1	Kenworthy, San Jacinto Mountains.....	Do.
29	San Jacinto.....	Stanford University collec- tion.
12	Hemet Valley.....	Do.
12	Coahuila Valley.....	Do.
2	Vicinity of Riverside.....	1, University of California Museum of Vertebrate Zo- ology; 1, Stanford Univer- sity collection.
SAN DIEGO COUNTY, CALIFORNIA.		
4	Pine Mountain, near Escondido.....	University of California Mu- seum of Vertebrate Zool- ogy.
3	Warners Pass.....	Do.
5	Cuyamaca Lake.....	Stanford University collec- tion.
1	Julian Mountains.....	Do.
16	Vicinity of Campo.....	Do.

	<i>Uta stansburiana</i> , from Fillmore, Utah; Humboldt County, vicinity of Pyramid Lake, Nevada; Lincoln County, Idaho; Lake County, Oregon.		<i>Uta stansburiana</i> , <i>elegans</i> , from La Paz, San Jose del Cabo, Lower California; Colo- rado River, Cali- fornia and Ari- zona; Albuquer- que, New Mexico.		<i>Uta stansburiana</i> , <i>hesperis</i> , from vicinity of Pasa- dena, Ontario, and San Jacinto, California.	
	Males.	Females.	Males.	Females.	Males.	Females.
Head, length:						
Minimum.....	8	9	9.9	9	9	9.5
Average.....	¹ 20	¹ 14	¹ 19	¹ 16	¹ 17	¹ 12
Maximum.....	10	9.4	10.7	9.6	10.8	10.1
Head, width:						
Minimum.....	11	10.2	11.9	10	13	10.5
Average.....	6.8	8	8	8.1	8.2	8.5
Maximum.....	¹ 20	¹ 15	¹ 19	¹ 16	¹ 16	¹ 12
Length from snout to anus:	9.1	8.5	9.3	8.5	9.4	9.1
Minimum.....	10.5	9.8	10.7	9.8	11.5	9.2
Average.....	31.5	40.4	39.5	38.5	39.5	42.3
Maximum.....	¹ 20	¹ 15	¹ 25	¹ 21	¹ 17	¹ 12
Length of fore leg:	46.7	45.7	45.2	43.5	47.1	48
Minimum.....	52.5	54	53.1	48.5	53	51
Average.....	14.5	15.9	18	15.2	17.1	17.2
Maximum.....	¹ 20	¹ 14	¹ 17	¹ 15	¹ 17	¹ 12
Length of hind leg:	19.3	17.2	18.9	18.4	20.2	19.1
Minimum.....	21.5	19	22.4	19.5	23.6	21
Average.....	23.2	27.9	29	27.8	30	30
Maximum.....	¹ 21	¹ 15	¹ 23	¹ 21	¹ 17	¹ 12
Average ratio, hind leg to length to anus....	33.3	29.7	33.5	30.4	35.3	33.2
Longest toe:	36.9	31.5	39	31	38.9	36
Minimum.....	¹ 23	¹ 15	¹ 23	¹ 21	¹ 17	¹ 12
Average.....	.714	.649	.741	.699	.750	.692
Maximum.....	11	12.5	14	13.2	14	13.9
Average.....	¹ 20	¹ 15	¹ 18	¹ 16	¹ 17	¹ 12
Maximum.....	14.8	13.6	15.6	14.1	15.7	15
Average femoral pores.....	16	14.5	17.1	15	17.3	16
Average gular scales.....	¹ 51			36	¹ 29	
Average belly scales.....	13+			14+	14+	
Dorsal scales:	¹ 31			¹ 56	¹ 30	
Minimum.....	33			32	31+	
Average.....	¹ 32			¹ 53	¹ 31	
Maximum.....	63			61+	60+	
Minimum.....	89			78	87	
Average.....	¹ 55			¹ 111	¹ 96	
Maximum.....	103.			86.5	102.3	
	116			103	117	

¹ Indicating the number of specimens from which the average was taken.

SCeloporus magister (Hallowell).

Locality.—This large scaly lizard was observed at Derby, the Pyramid Lake Indian Agency, and at several points along Pyramid Lake as far as The Willows. Specimens were collected at the points mentioned. Previously it has been reported in the Lahontan Basin at Wadsworth, Nevada.

The series of 21 specimens from the above-mentioned localities agrees in scale characters with *Sceloporus magister* as defined by Stejneger (1893, pp. 178-182). However, none of these specimens exhibit such large dimensions as some Arizona individuals and the femoral pores are fewer in number. Four Arizona specimens examined are decidedly darker than any obtained by us in the Lahontan Basin. They show a very pronounced broad dorsal stripe of black

intermingled with lighter, and are darker laterally and ventrally. The following table will give the range of variation in adults. Measurements of four Arizona specimens are given for comparison:

	Vicinity of Pyramid Lake, Nevada.		Fort Lowell and Tempe, Arizona, 4 males.
	Ten males.	One female.	
Head, length:			
Minimum.....	16.1	.....	20
Average.....	18.1	16	20.8
Maximum.....	20.3	.....	22.5
Head, width:			
Minimum.....	18	.....	23.5
Average.....	20.8	17	24.5
Maximum.....	24.9	.....	26.8
Length from snout to anus:			
Minimum.....	75	.....	104.5
Average.....	94	82.2	113.2
Maximum.....	107	.....	119.5
Length of tail:			
Minimum.....	104.9	.....	139
Average.....	124.4	109	150.2
Maximum.....	141.5	.....	157
Length of fore leg, including claw:			
Minimum.....	34.5	.....	45
Average.....	39.6	34.9	46.9
Maximum.....	44.5	.....	51.4
Length of hind leg, including claw:			
Minimum.....	51.9	.....	68
Average.....	59.1	52.9	71.6
Maximum.....	65	.....	76
Length of longest toe, including claw:			
Minimum.....	23.2	.....	28
Average.....	26.4	24	30.6
Maximum.....	28	.....	32.5
Femoral pores:			
Minimum.....	11	12	12
Average.....	11+	.....	13+
Maximum.....	13	13	15
Dorsal scales from interparietal to point above posterior surface of thighs:			
Minimum.....	32	.....	31
Average.....	33+	33	32
Maximum.....	35	.....	34

Habits.—At Derby *Sceloporus magister* was found in two distinct habitats, in and about bushes near the river where it was found most abundantly, and on rocky hillsides. At Wadsworth it was taken in bushes not far from the river. In the vicinity of Pyramid Lake it was observed in bushes along the river, on tufa cliffs near the lake, or on volcanic rocks in the near by hills, also along the lake shore, but never very far out on the desert.

As it runs from bush to bush *Sceloporus magister* lifts its tail above the level of its body in much the same manner as *Callisaurus*, a trait which facilitates rapid movement over the sand. It is occasionally seen basking on rocks in company with the smaller *Sceloporus biseriatus*. This lizard is an adept climber and ascends to the tops of tall bushes with great ease.

SCELOPORUS GRACIOSUS Baird and Girard.

Locality.—The collection contains specimens of this small *Sceloporus* from Tallac, California, and from Carson City, Palisade, and Deeth, Nevada. The only other records from the Lahontan Basin with

which I am acquainted are Winnemucca, Amos, Quinn River Crossing, vicinity of Pine Forest Mountains, and Virgin Valley, Humboldt County, Nevada.

Status and variation.—The series from Tallac, California, presents some minor differences from specimens collected in Nevada. Thus the largest specimens in the California series are smaller than the largest from Deeth, Nevada. This discrepancy is best shown in the tail length, 68.1 being the maximum in specimens from Tallac, California, 78.8 the maximum in Deeth, Nevada, specimens. The averages in tail length are likewise distinct. The femoral pores vary from 10 to 15, average 12+ in Tallac specimens; from 13 to 17, average 15+ in Deeth specimens. The accompanying table will show the extent of variation and averages in the specimens collected:

	Near Tallac, Lake Tahoe, California.		Deeth, Elko County, and near Palisade, Nevada.		Near Carson City Nevada, 3 males.
	Nine males.	Three females.	Seven males.	Three females.	
Head, length:					
Minimum.....	9.5	10	9.5	9.6	10.5
Average.....	10.4	10.6	10.6	10.2	10.9
Maximum.....	11	11	12	11	11.4
Head, width:					
Minimum.....	9	8.5	8.5	8.3	10
Average.....	9.5	9	10.1	9.1	10.5
Maximum.....	10	9.5	12	10.2	11
Length, snout to anus:					
Minimum.....	44.1	50	42.1	44.1	51
Average.....	48.4	51.8	51.2	50.6	53.5
Maximum.....	51.3	55	58.5	58.4	56
Tail, length:					
Minimum.....	59		66	68.5	
Average.....	¹ 7 63.3	¹ 1 58.1	¹ 4 71.9	¹ 2 70	¹ 2 70
Maximum.....	68.1		78.8	71.5	
Length of foreleg:					
Minimum.....	19	19.5	17	17.7	19.5
Average.....	¹ 7 19.6	20.2	¹ 6 20	20.7	20.8
Maximum.....	20.5	21	23.5	23.5	22
Length of hind leg:					
Minimum.....	29	30	27	27	31.9
Average.....	31.1	30.9	32.8	31.3	34.1
Maximum.....	33.5	31.9	38	34.3	35.5
Longest toe, including claw:					
Minimum.....	14.4	15	14.5	14.9	15.5
Average.....	15	15.5	15.8	15.8	15.7
Maximum.....	16.1	16	17	16.5	17.8
Femoral pores:					
Minimum.....	10		13		12
Average.....	12+		15+		13
Maximum.....	15		17		15
Dorsal scales:					
Minimum.....	46		48		47
Average.....	51		53+		51
Maximum.....	55		58		54

¹ Indicating the number of specimens from which the average was taken.

Tallac specimens can be readily separated from the Deeth, Nevada, series by their darker color. The two dorsal and the two lateral rows of brown spots, often confluent, are darker, and the blue patches on the bellies of the males have a stronger admixture of black. There

is a very pronounced brown preanal spot on the males. The three Carson City specimens are intermediate between the Tallac and Deeth series. The single specimen from Palisade, Nevada, does not differ from Deeth specimens.

Habits.—*Sceloporus graciosus* was observed at Tallac California, on low, sparsely forested moraines among *Artemisia tridentata*, *Arc-tostaphylus*, sp. and *Ceanothus*, sp. At Carson City, Palisade, and Deeth, Nevada, it was collected in growths of *Artemisia tridentata*. The stomachs of seven individuals collected at Tallac were examined, with the following results: three contained insects only, while four held insects and bits of plant leaves. The identified insects were small beetles, one ichneumon fly, and ants, beetles being the most abundant. Small larvae were found in two stomachs.

Two females collected at Tallac on June 16 held two and three large eggs, respectively. One shot on June 19 contained four eggs.

SCELOPORUS BISERIATUS Hallowell.

Locality.—Specimens were collected at Tallac, California, and at Reno, Carson City, Derby, Pyramid Lake Indian Agency, The Willows on Pyramid Lake, and Palisade, Nevada. It was seen at Tahoe City, Truckee, and Susanville, California. There is also one specimen from the Palmetto Mountains, southwest of Barrel Springs, Esmeralda County, Nevada, in the Stanford University collection. The species has been previously found at Pyramid Lake and at Quinn River Crossing, Virgin Valley, and in the vicinity of the Pine Forest Mountains, Humboldt County, Nevada.

Status.—I can detect no marked differences between the series from the above localities and typical specimens from southern California. The number of dorsal scales in a line from the interparietal plate to a point above the posterior surfaces of the thighs varies in 34 specimens from 38 to 48, average 42.7. The femoral pores range in 31 specimens from 13 to 23 on each thigh, average 16.9

The series is quite uniform in dorsal coloration. Young specimens have two rows of wavy dark-brown blotches, which generally fade and become indistinctly outlined in the adults. The space between the blue patches on the ventral surface of adults is usually clouded over with black pigment, except for a gray line separating them. The black pigment often extends over the ventral surface of the femurs. The single blue throat spot is more or less surrounded by black. The under surface of the tail is suffused with dark pigment which gives it a gray appearance. Females are less heavily pigmented ventrally than males. The young of both sexes resemble the adult females in ventral coloration.

Habits.—Throughout the Lahontan Basin covered by this expedition *Sceloporus biseriatus* proved to be a rock-dwelling form. It was

found on large granite boulders at Tallac, California, and on volcanic rocks in various parts of Nevada. Along the southwest shore of Pyramid Lake it was often accompanied by *S. magister*. Here and at Derby many dark-colored individuals basked on rocks in the sun. Some were almost pure black and conspicuous for a considerable distance. This color vanishes so rapidly after death that dark-colored individuals will assume the normal gray-brown tint in less than three hours.

Two females taken on May 24 at Reno, Nevada, held 7 and 10 large eggs, respectively. One taken at Tallac June 17 also contained eggs.

A young male shot at Reno May 24 had green aphids, three or four large ants, and other unidentified insect fragments in its stomach.

PHRYNOSOMA PLATYRHINOS Girard.

Locality.—This "Horned toad" was observed in considerable abundance along the lower Truckee River in Washoe County, Nevada, where Cope (1883) has previously recorded it. Specimens were secured from the following localities: Derby, Wadsworth, Pyramid Lake Indian Agency, southwestern shore of Pyramid Lake, between the Truckee River and The Willows. In addition, there are two specimens in the Stanford University collection from Esmeralda County, Nevada, collected by John D. Reed. Other localities within the basin where it has been observed are: Virginia City, Camp "12," and Quinn River Crossing, Amos, Thousand Creek Basin, and a number of points near the Pine Forest Mountains, Humboldt County, Nevada.

Status and variation.—The 28 specimens are typical of *Ph. platyrhinos*. There are 5 or 6 temporal horns, normally 1 occipital horn which may have 1 or 2 smaller supernumerary horns about its base. These may project directly backward, they may curve perceptibly upward, or rarely downward toward the back. There are 2 post-oculars, 3 large occipital plates, from 7 to 10 supralabials, the usual number being 8 or 9, and from 4 to 7 scales on the frontal angle between the canthal rows, average in 16 specimens, 5.5. The lower group of spines on the neck may be continuous with the row of weakly spinose gulars, or they may be abruptly separated from these, the most frequent condition in this series. The tympani may be exposed, partially exposed, or totally concealed by the integument, all these conditions prevailing in young and adults alike. A noticeable difference between the adult males and females is the broad, thickened base of the tail in the former.

The color (in alcohol) is as follows: Light gray dorsally, often suffused with brick red. Head generally with prominent black spots in young individuals, but faded and indistinct in adults. A pair of

dark blotches on the neck varying in intensity. From three to five irregular pairs of dark blotches or lines, usually black, on the back. Tail transversely banded with broad gray or reddish stripes with darker posterior borders. The whole dorsal pattern in some specimens is confused. Under surface white, immaculate, or irregularly spotted with black or slate.

Habits.—*Phrynosoma platyrhinos* was invariably found on the desert among low bushes, under which it ran when pursued. It seemed to rely upon this method of escape rather than that of hiding in the burrows of small mammals, a habit of many desert lizards. When hard pressed it crawled close to the stalk of a bush, around which it dodged with considerable alacrity. When it ran any great distance it often raised its tail above the level of the sand in a manner suggestive of the more agile *Callisaurus*.

Two individuals whose stomachs were opened had eaten a mass of insects, chiefly ants and beetles, besides a number of larvae which could not be identified.

A female captured during the last week in May contained 13 large eggs. Two others taken on June 2 held 9 and 13 eggs, respectively.

PHRYNOSOMA DOUGLASSII HERNANDESI (Girard).

Locality.—Five females of this species were collected at Deeth, Elko County, Nevada, on July 5, furnishing a new record for the Lahontan Basin. Yarrow (1882 *b*) lists as *Phrynosoma douglassii douglassii* two specimens from Saint Thomas, Arizona. Saint Thomas is in Lincoln County, Nevada, and the specimens, though now lost, probably represented this form.

Status and variation.—All these specimens have large, reddish head spines and occipitals projecting backward parallel with the temporals, except in one specimen in which the occipitals are raised at a slight angle. The parietal region of the head in the Nevada specimens is but little lower than the frontal region, while many specimens from Arizona and New Mexico show a decided depression of the former. Associated with this peculiarity, is a well marked antero-posterior curvature of the supraorbital ridge, which in most of the specimens examined from Arizona and New Mexico is quite straight. However, these characters are subject to considerable variation in all the specimens with which the Nevada series was compared. The five specimens have exposed tympani; the femoral pores range from 13 to 18, average 15.8.

The color in the preserved specimens is as follows: Head brown or reddish brown. Two large black nuchal patches and at least two more blotches on either side of the back each bounded posteriorly with an interrupted white line. Under surface dull white variously marked with slate.

I find that the Nevada specimens in question represent a race almost intermediate between true *Phrynosoma douglassii douglassii* and the southern form *hernandesi*. Still in their larger size and longer head spines they more closely approach the southern form. For this reason it seems best to follow Cope (1898) in the use of a trinomial. A small specimen in the United States National Museum collection, locality "Salt Lake to Carson's Pan, Utah," is exactly comparable to the two smaller specimens from Deeth, Nevada. The following table will give the size relations between *Phrynosoma douglassii douglassii*, *Phrynosoma douglassii hernandesi* from northern Nevada, and *Ph. douglassii hernandesi* from Arizona and New Mexico:

	<i>Ph. douglassii hernandesi</i> , Deeth, Elko County, Nevada, 5 females.	<i>Ph. douglassii douglassii</i> near Abert Lake, Lake County, Oregon.		<i>Ph. douglassii hernandesi</i> , Arizona and New Mexico.	
		Two Males.	Three females.	Five males.	One female (juv.).
Total length:					
Minimum.....	75	70	78.5	72.5	.....
Average.....	103.4	74	90.1	108.8	66.5
Maximum.....	123	78	97	130	.....
Tail length:					
Minimum.....	24	23.5	22	27	.....
Average.....	32.1	25.7	25.6	38.3	21
Maximum.....	39	28	28	46	.....
Width of head:					
Minimum.....	16	13	15.5	15.2	.....
Average.....	20.9	14	17.6	22.9	16.1
Maximum.....	25	15	18.7	28.5	.....
Snout to ear:					
Minimum.....	13	11	13	12.5	.....
Average.....	16.4	11.5	13.8	17	13
Maximum.....	19	12	14.5	20	.....
Length of occipital horns:					
Minimum.....	1.9	1.1	1.3	2	.....
Average.....	2.4	1.1	1.5	2.9	1.5
Maximum.....	3	1.2	1.8	4	.....
Length of foreleg:					
Minimum.....	22.8	19.1	22.5	21	.....
Average.....	27.7	20.1	24.8	31.3	22.5
Maximum.....	32	21.1	27	36.5	.....
Length of hindleg:					
Minimum.....	30	26	30	30	.....
Average.....	37.9	27.5	32	40.6	30.5
Maximum.....	45	29	35	47.5	.....
Longest toe:					
Minimum.....	12.6	.....	10.5	10	.....
Average.....	14.7	10	11.2	13.9	10
Maximum.....	16	.....	12	16.8	.....
Ratios to total length:					
Tail—					
Minimum.....	.285	.335	.281	.315	.....
Average.....	.311	.346	.284	.353	.315
Maximum.....	.326	.358	.289	.378	.....
Width of head—					
Minimum.....	.190	.185	.191	.197	.....
Average.....	.203	.188	.195	.211	.242
Maximum.....	.213	.192	.197	.227	.....
Snout to ear—					
Minimum.....	.151	.153	.148	.147	.....
Average.....	.160	.155	.154	.157	.195
Maximum.....	.173	.157	.165	.172	.....

GERRHONOTUS PALMERI (Stejneger).

Locality.—The Stanford University collection contains three specimens of *Gerrhonotus palmeri* from the vicinity of Fallen Leaf Lake,

California, collected by C. V. Burke. One was seen by us in a canyon near Tahoe City on June 27. This is apparently the first record of this species in the Lahontan Basin since it has previously been found only on the western slope of the Sierra Nevada Mountains (Van Denburgh, 1898).

Status and variation.—The specimens are very typical. The temporal scales are keeled, except in the smallest individual, in which the keels are obsolete. There are 16 rows of strongly keeled dorsal scales, a single interocular, a large azygous prefrontal, larger than either of the paired prefrontals and the dark ventral lines are absent in one, present between the ventral scales in another, and indefinite in the smaller specimen.

CNEMIDOPHORUS TIGRIS Baird and Girard.

Locality.—*Cnemidophorus tigris* was an abundant species at Derby, Wadsworth, Pyramid Lake Indian Agency, and along Pyramid Lake to The Willows. It was also taken at Carson City and was seen at Winnemucca, in Humboldt County, and Palisade, Eureka County, Nevada. It has been taken before in the Lahontan Basin near Wadsworth, Washoe County; Carlin Elko County and Pine Forest Mountains (vicinity of Big Creek Ranch), Humboldt County, Nevada.

Status and variation.—The 43 specimens obtained are identical with specimens in the Stanford University collection from southern Idaho (vicinity of Blue Lake, Lincoln County, and Conant, Cassia County).

The color variations in this species have been described by Stejneger (1893, p. 199), and more recently by Meek (1905, p. 13). Specimens from the Lahontan Basin appear to vary in the same manner as those from southern Nevada and California. The abundance of black pigment on the throat and breast as noted by Stejneger is not dependent upon size or sex. The dorsum likewise has a variable color pattern.

Habits.—This species was found most abundantly at Pyramid Lake among the low-growing desert bushes. At Carson City a number of specimens were taken in a growth of *Artemisia tridentata*. In the eastern part of the basin, it was encountered but twice, at Winnemucca and Palisade where it was seen in growths of *Artemisia tridentata*.

When frightened, *C. tigris* seeks the shelter of a bush and will often hide in the holes of *Citellus mollis* and other mammals. Occasionally it was observed to climb into bushes.

The stomachs of six individuals taken on May 31 were filled with large white larvae and pieces of gravel. A single spider was also found in one specimen. The insect prey of this species, according to the observations of Professor Snyder, is picked up by means of the long slender tongue.

CHIONACTIS ISOZONUS (Cope).

Locality.—A single specimen of this beautiful little snake was presented to the Stanford University collection by E. J. Newcomer. It was found beneath a rock on a rise above the southwest shore of Pyramid Lake, Nevada, about the 1st of June, 1911. This is, to my knowledge, the first definite record for Nevada, although Yarrow (1875, p. 537) cites two specimens without precise locality, which were procured in the State in 1871. The capture of *Chionactis isozonus* at Pyramid Lake, Nevada, therefore establishes a new northern station considerably beyond any previous one.

Description.—Cephalic plates normal; anterior and posterior nasals united; 1 loreal; 1 preocular, 2 postoculars; temporals 1 followed by 2; supralabials 7, third and fourth in contact with the eye; infralabials 7, the fourth the largest; post geneials less than one-third the length of the anterior geneials. Dorsal scales smooth, in 15 rows. Anal plate divided. Ventrals, 164. Caudals, 49. Total length, 215 mm.; tail length, 44 mm.

The following color notes pertain to the specimen several days after it had been placed in formalin: Head, dorsally, dark brown with a pink suffusion, darkest on the parietal and posterior part of the frontoparietal and supraocular plates. Dorsal part of body with 27 transverse bands of a leaden blue color, 3 or 4 scales wide, which do not appear on the ventral surface, but gradually fade out on the sides. Tail with 9 bands of the same color which form almost complete annuli, paler ventrally. Spaces between the dorsal bands dull rose pink, 3 scales wide. Ventral surface light olive green, a peculiar shade difficult to describe.

CHARINA BOTTAE (Blainville).

Locality.—This interesting little boa was not seen by us in this region but there is a specimen in the Stanford University collection from the vicinity of Fallen Leaf Lake, Eldorado County, California, collected by C. V. Burke. *Charina bottae* has been recorded from the Lahontan Basin at Eagle Lake, Lassen County, California, and at the "Great Bend of the Truckee River (Wadsworth) and the Humboldt River, Nevada."

Description.—Internasals 2; prefrontals 5; 1 large frontal; 1 large parietal plate, smaller than frontal, with 6 smaller plates touching its posterior and posterolateral edge; preoculars 1-1; postoculars 4-4; supraoculars 1-1; suboculars 0-1; labials in contact with eye 1-1; loreals 1-1; scale rows 45 (maximum number); ventrals 205; subcaudals, 38. Color (from preserved specimens), olive-brown, dorsally; pale lemon yellow ventrally.

PITUOPHIS CATENIFER DESERTICOLA Stejneger.

Locality.—The desert gopher snake or bull snake was found at two points in the Lahontan Basin. The two specimens are from Pyramid Lake and Carson City, Nevada. There are also two young individuals in the Stanford University collection from Esmeralda County, Nevada. It has been found previously in this region at Winnemucca and in the Pine Forest Mountains, Humboldt County, Nevada.

Status and variation.—These specimens do not differ in squamation from individuals of *Pituophis catenifer* taken in California west of the Sierra Nevada divide. The maximum number of dorsal scale rows is 31 in two individuals and 33 in the others. The number of unkeeled lateral scale rows, counted on each side at a point one tail length back of the posterior edge of the parietal plate, is as follows: 7–8 (Carson City specimen), 8–9 (Pyramid Lake specimen), 9–10 (Esmeralda County specimens).

In color, however, these specimens differ considerably from true *catenifer*. The ground color, especially along the sides, has less of the brown suffusion characteristic of *catenifer*, and the resulting pattern is much more striking. In this respect both the young and the adults agree.

Habits.—The gopher snake from Pyramid Lake was captured on top of a rat's nest (*Neotoma*, sp.) where it lay coiled. Its stomach contained a ground squirrel, *Citellus mollis*, which had recently been eaten. The Carson City specimen was captured under a small sage-bush not far from a river bank. It contained large eggs (July 9).

BASCANION CONSTRICTOR VETUSTUM Baird and Girard.

Locality.—Two male specimens of this snake from Holbrook, Douglas County, Nevada, are in the Stanford University collection. The species has been recorded from the Lahontan Basin at Honey Lake, California, and near Wadsworth, Nevada.

Variation.	Male.	
Supralabials.....	7-8	7-7
Infralabials.....	8-8	8-8
Preoculars.....	2-4	2-3
Postoculars.....	2-2	2-3
Temporals.....	1-1	2-2
	1-1	2-2
Ventrals.....	172	174
Subcaudals.....	¹ 93	91
Total length.....mm.	763	501
Tail length.....mm.	207	132.5

¹ Eight of the subcaudals undivided.

BASCANION FLAGELLUM FRENATUM Stejneger.

Locality.—A single specimen of the “red racer” was secured on June 4, at Winnemucca Lake, Washoe County, Nevada. This is

apparently the first time the species has been observed in the Lahontan Basin. All previous records for the State are from southern Nevada.

Description.—This specimen has dark bars on the neck and spotted throat typical of *frenatum*. The supralabials are 8–8, the infralabials 10–10, preoculars 2–2, postoculars 2–2, temporals 2–3, the maximum dorsal scale rows 17, ventrals 188 (tail injured).

Habits.—This snake was shot at the edge of a slough as it was attempting to swallow a *Callisaurus v. myurus* which was still struggling in its jaws.

BASCANION TAENIATUM (Hallowell).

Locality.—*Bascanion taeniatum* was found at Carson City and Pyramid Lake, Nevada. It is quite generally distributed throughout the Lahontan Basin as is shown by the following published records: Carson City, Quinn River Crossing, and Pine Forest Mountains, Humboldt County, Nevada.

Description and variation.—The three specimens show but slight variation in scale characters. The supralabials are 8–8, infralabials 10–10, with one exception of 9–10, preoculars and postoculars both 2–2, temporals 2 followed by 2 on each side, the maximum number of dorsal scale rows 15, ventrals, 198, 207, 210, subcaudals 122 and 134 in two specimens. Total length, 1,127 mm. and 1,326 mm. (2 specimens); tail length 334 mm. and 416 mm. (2 specimens).

The color pattern is very constant, agreeing with the descriptions given by Cope (1898) and Van Denburgh (1897).

Habits.—At Carson City the “striped racer” was collected in rather heavy growths of *Artemisia tridentata*; at Pyramid Lake on the more open desert among low-growing bushes.

THAMNOPHIS SIRTALIS PARIETALIS (Say).

Locality.—This garter snake was secured in the vicinity of Tallac, on Lake Tahoe, and at Susanville, Lassen County, California. It has been previously captured within the basin at Lake Tahoe, Wadsworth, and the Truckee River, Nevada.

Status and variation.—The six specimens obtained vary in squamation, as the following table shows:

	Sex.	
	Males.	Females.
Preoculars, 1-1.....	2	4
Postoculars:		
3-3.....	2	2
3-4.....		1
4-4.....		1
Temporals, 1+2, 1+2.....	2	4

	Sex.	
	Males.	Females.
Supralabials:		
7-7.....	1	4
7-8.....	1	
Infralabials:		
10-10.....	2	3
10-11.....		1
Dorsal scales, 19-17.....	2	4
Ventrals:		
Minimum.....	168	159
Average.....	¹ 2	¹ 4
Maximum.....	169	163.5
Subcaudals:		
Minimum.....		75
Average.....	¹ 1	¹ 2
Maximum.....	91	75.5
Total length:		
Minimum.....		575
Average.....	¹ 1	¹ 2
Maximum.....	536	612.5
Tail length:		
Minimum.....		136
Average.....	¹ 1	¹ 2
Maximum.....	141	147.5
Average ratio tail to total length.....	¹ 1	¹ 2
	.263	.240

¹ Indicating the number of specimens from which the average was taken.

The color pattern of these specimens is quite typical. The dorsal spots are fused and the red interspaces are restricted to areas on the skin about the length of one scale. The red pigment often encroaches upon the edges of adjacent scales. These specimens closely resemble many in the Stanford University collection from northern California and western Oregon.

Habits.—With one exception, *parietalis* was found near the margin of streams. The one other individual was found on a road several hundred feet from water. From our observations this species was not nearly so abundant as *Thamnophis ordinoidis elegans*.

THAMNOPHIS ORDINOIDIS ELEGANS (Baird and Girard).

Locality.—Specimens of this form were collected at the following localities in California: Tahoe City, Lake Tahoe (3); vicinity of Tallac, Lake Tahoe (22); near Fallen Leaf Lake, Lake Tahoe (4); (C. V. Burke collector) Glen Alpine, near Lake Tahoe (1). Also the following in Nevada: Wadsworth (1); Pyramid Lake Indian Agency (1); Winnemucca Lake, Washoe County (1); near Carson City (2); vicinity of Palisade, Eureka County (11); Deeth, Elko County (1).

This species has been observed before in the basin by previous writers at Camps “10” and “12,” Lake Tahoe, Nevada, and in Humboldt County, Nevada, at Quinn River Crossing, Pine Forest Mountains, Virgin Valley, and Thousand Creek Flat.

Status and variation.—This fine series of specimens which reveals considerable variation in squamation and color is unquestionably

referable to *Thamnophis ordinoidis elegans* (Baird and Girard) as defined by Ruthven (1908). The specimens have been grouped into three series and their more pronounced variations are here tabulated.

Locality.	Sex.	Pre-oculars.			Post-oculars.			Temporals.				Supra-labials.			Infralabials.			
		1-1	1-2	2-2	2-3	3-3	3-4	1+2 1+2	1+2 1+3	1+3 1+3	1+3 1+4	8-8	8-9	9-9	9-10	10-10	10-11	11-11
Tahoe Series.—Tahoe City, vicinity of Tallac, near Fallen Leaf Lake and Glen Alpine, California.....	Males...	18	3	...	2	18	1	15	1	4	1	17	4	...	2	17	2	....
	Females	8	...	1	1	7	1	6	2	1	....	7	1	1	1	6	2	....
Carson Series.—Carson, Wadsworth, Pyramid Lake Indian Agency, and Winnemucca Lake, Nevada.....	Males...	1	...	1	...	2	...	1	1	....	....	2	...	...	...	2	....	....
	Females	2	...	1	...	3	...	2	1	....	....	3	...	...	...	2	....	1
Palisade Series.—Pine Creek, near Palisade, Eureka County, and Deeth, Elko County, Nevada.....	Males...	2	...	...	...	2	...	1	...	1	...	2	...	...	...	2	...	....
	Females	10	...	...	2	8	...	6	3	1	...	10	...	...	...	8	2	....
Total, 47 specimens.....	Males...	21	3	1	2	22	1	17	2	5	1	21	4	...	2	21	2	....
	Females	20	...	2	3	18	1	14	6	2	....	20	1	1	1	16	4	1

Locality.	Sex.	Dorsal scales.						Ventrals.			Subcaudals.			Total length.			Tail length.		
		19-17	19-21-19-17	21-19-17-15	21-19-17	21-23-21-19-17	23-21-19-17	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.
<i>Tahoe Series.</i> — Tahoe City, vicinity of Tal- lac, near Fal- len Leaf Lake and Glen Al- pine, Cali- fornia.....	Males...	3	12	...	5	....	1	161	{ ¹²¹ 169.3	177	76	{ ¹¹⁴ 84.2	95	224	{ ¹¹⁴ 409.8	652	52	{ ¹¹⁴ 103.8	168
	Females	1	5	...	2	1....		165	{ ¹⁹ 168.1	177	78	{ ¹³ 81.3	86	233	{ ¹³ 408	672	40	{ ¹³ 90.1	140
<i>Carson Series.</i> — Carson, Wads- worth, Pyra- mid Lake In- dian Agency, and Winne- mucca Lake, Nevada.....	Males...	..	2	..	..	..	..	{¹² 175	...	95	{ ¹² 95.5	96	639	{ ¹² 661.5	684	148	{ ¹² 167.5	187	
	Females	..	3	..	..	..	176	{ ¹³ 173.6	178	72	{ ¹² 74	76	664	{ ¹² 694.5	725	149	{ ¹² 156	163	
<i>Palisade Series.</i> — Pine Creek, near Palis- ade, Eureka County, and Deeth, Elko County, Ne- vada.....	Males...	..	..	..	2	..	173	{ ¹² 175.5	178	83	{ ¹² 85	87	429	{ ¹² 520	611	108	{ ¹² 132.5	157	
	Females	..	2	1	7	..	166	{ ¹¹⁰ 172.3	176	73	{ ¹⁷ 78.7	88	283	{ ¹⁷ 492.1	791	65	{ ¹⁷ 117.1	184	
Total, 47 specimens.	Males...	3	14	...	7	....	1	161	173.2	178	76	88.2	96	224	530.4	684	52	134.6	187
	Females	1	10	1	9	1....		165	171.3	178	72	78	88	233	531.5	791	40	121	184

¹ Indicating the number of specimens from which the average was taken.

Normally there is one preocular scale on each side of the head, but three individuals in the Tahoe series have the asymmetrical number

of 1-2, while one in the Tahoe series and two in the Carson series have the increased number of two on each side. The postoculars usually number three on each side with asymmetrical variations of 2-3 and 3-4, the former the more prevalent. The variations tend toward a reduced number of postoculars. There are usually one anterior and two posterior temporals on each side, but the variants show a definite tendency to increase the posterior number to three and even four. The supralabials are 8-8 with variations of 8-9 and more rarely 9-9. Ruthven (1908 p. 144) found that the variations approach a smaller number than eight and indeed noted only one individual out of 218 with the asymmetrical number of 8-9. There are usually ten infralabials, although ten specimens have a larger or smaller number. The reduced number of 9-10 occurs three times, the asymmetrically increased number of 10-11, six times and the increased number of 11-11, once. Ruthven (1908, p. 144) recorded the reduced number of 9 as more frequent than the increased number of 11. In the number of dorsal scale rows, the series are divided. Individuals in the Tahoe and Carson series have the formula, 19-21-19-17 more frequently, while 21-19-17 is most prevalent in the Palisade series. Variants with the extremes 19-17 and 23-21-19-17 occur in the Tahoe series while the range in the Palisade series is 21-19-17-15 to 21-19-17. The snakes in the Tahoe series have a smaller average number of ventral plates, 169.3 in the males against 175 and 175.5 in the males of the Carson and Palisade series. The averages of total length and tail length are considerably lower in the Tahoe series than in the Carson and Palisade series. The ratios of tail length to total length for the three series are: males, average, 25.3 per cent; females, average, 22.7 per cent.

When the average number of variations per individual specimen in the preocular, postocular, temporal, supralabial, and infralabial scales is calculated for each series, it is evident that the Tahoe series shows the greatest amount of variation, averaging 1.03 deviations from the normal per individual. The Carson series is second with an average of one variation, the Palisade series third with an average of 0.75 variations per individual. The amount of material is too small to render possible far-reaching conclusions, but it is interesting to note that the greatest variation occurs in the mountain inhabiting individuals, the least in desert inhabiting ones.

A manifest diversity of coloration is evident when the three series are compared. Twenty-four specimens in the Tahoe series have three distinct stripes, the median dorsal one, dull white or yellow in color, occupying the median and varying amounts of the proximal half of the row to either side of it, the lateral ones, gray in color, involving the second and all or a part of the third row on each side of the body.

Between the stripes, on the dorsal surface, the color is solid black broken by light spots which show between the scales when the skin is stretched. The dorsal surface of the head is olive brown, lightest on the snout, and often blending into the black dorsal color posteriorly. The throat is dull white or light yellow, the belly variously mottled with slate, often very faintly so. Some of the supralabials are always edged with black. Seventeen specimens with this dark color pattern have a dorsal scale formula of 19-21-19-17, four 19-17, and three 21-19-17. Only one specimen shows a variation in the preocular scales with the asymmetrical number of 1-2. Two specimens have 3-4 postoculars, two have 8-9, and one 9-9 supralabials. Many of these specimens closely agree with the description of Baird and Girard's type from Eldorado County, California.

Six samples of this species in the Tahoe series (two from Tahoe City, three from Fallen Leaf Lake, and one from Glen Alpine) are of a different type of coloration. The median dorsal stripe is absent except for an indication just back of the head, but in one specimen even this indication has disappeared. In three specimens the lateral lines are present and normal, in two they are absent, in one they are but faintly indicated. The dorsal color ranges from olive brown, through dark olive brown to a color which approximates black. One specimen has a row of black spots along the lateral lines. The head above is usually dark olive brown, but in one individual it is lighter olive, while in another it is almost black. The throat is light yellow except in one individual in which the color is gray white. The belly in five individuals is blue gray marked with slate, or slate colored, light green in the sixth. The dorsal scale formula in four specimens is 21-19-17, in one 21-23-21-19-17, and in another 23-21-19-17. The preoculars vary in three individuals, being 1-2 in two and 2-2 in the third. There are variations of 8-9 supralabials and 10-11 infralabials in three specimens. One specimen has the squamation of *Thanmophis vagrans biscutata* (Cope) as defined by Van Denburgh (1897, p. 212); (preoculars 2-2, dorsal scale rows 21-23-21-19-17). Another specimen has 1-2 preoculars and 23-21-19-17 dorsal scale rows. The examination of a large series of specimens in the Stanford University collection from various parts of California and the Northwest firmly convinces me that *biscutata* does not deserve recognition.

The Carson series resembles the six lighter colored specimens in the Tahoe series, but is collectively still lighter. The median dorsal stripe is absent in all but one specimen except for a mere suggestion just back of the head. The lateral stripes are present in two and absent in three specimens. The dorsal surface is lighter and except in one individual there is a more or less definite row of dark spots on each side near the lateral line. The head is olive or olive brown,

throat light yellow, yellow or dull white, belly green with slate markings, light yellow, gray, gray brown, or brown with a green tinge.

The Palisade series shows little diversity in color. The median dorsal stripe is present in all specimens and is gray-white in color. The lateral stripes are darker gray than the dorsal stripe. The dorsal color is olive or olive brown with one or two rows of black spots on either side of the median stripe which vary considerable in size, the upper series often encroaching upon the median stripe. The head is olive or olive brown, the throat light yellow or gray-white, the belly gray or blue gray sometimes with a green tinge and often mottled heavily with slate. Except in the uniform presence of the median dorsal stripe, this series does not differ from the Carson series.

Habits.—At Tallac, California, garter snakes of this species were seen frequently along small streams where they were catching minnows (*Agosia* and *Richardsonius*, sp.) which were running up from the lake to spawn. Although a frog (*Rana pipiens*) was taken from the stomach of one snake, practically all of those dissected contained minnows. A dozen or more had collected at the foot of a dam on the Humboldt River, 9 miles below Palisade, Nevada, where they were fairly gorging themselves upon the fish which were running in great numbers at that time. A specimen secured at Pine Creek near Palisade was attempting to swallow a Cottoid (*Cottus beldingi*) head first, but was experiencing some difficulty on account of the large spine-armed head of its victim. From field observations and stomach dissections, it is clear that the smaller minnows form the chief food of *elegans* in the Lahontan Basin during the greater part of June and July. Never did we observe this garter snake far from water.

Four females containing large eggs were obtained at the following places: one from Pyramid Lake Indian Agency, Nevada, May 25–27; one from Tahoe City, California, June 27; and two from the vicinity of Palisade, Nevada, July 3 and 4. Five young specimens in the collection from the vicinity of Tallac (June 10–24) had very prominent scars marking the attachment of the yolk sac which suggested that they were of recent birth. None of the other adult females, however, contained large eggs.

CROTALUS OREGONUS Holbrook.

Locality.—Only one specimen of this species was secured, although it was reported to be abundant in several of the localities visited. The one individual came from the hills east of Pyramid Lake Indian Agency, Nevada, on May 28. It has been recorded previously from the vicinity of Pyramid Lake and the Truckee River, Nevada. Speci-

mens collected by Dr. W. P. Taylor and myself at Quinn River Crossing and the vicinity of Pine Forest Mountains, and others taken by Miss Alexander and Miss Kellogg in Virgin Valley, Humboldt County (see Taylor, 1912, pp. 355-356), probably represent the same form which inhabits the Pyramid Lake region.

Description and status.—One anterior and one posterior nasal, internasals irregular in six rows; preoculars 2-2; scales in contact with eye between preoculars and supraoculars 5-6; supraoculars 1-1; a large scale in front of the supraocular on each side; scale rows between supraocular plates 8; supralabials 15-17; infralabials 16-17; dorsal scale rows just back of the head 27; maximum number on trunk 25, first row on each side unkeeled, second with obsolete keels; ventrals 180; subcaudals 25, the distal two divided; total length (exclusive of rattle), 968; tail length (without rattle), 71.

Color (alcoholic specimen).—Above light brown with numerous brownish black ocelli surrounding a darker ground color. On the posterior part of the body these ocelli become constricted to form transverse bands, those near the tip of the tail becoming irregular. Ventral surface dull white with a gray suffusion, generally heaviest on the outer anterior edge of each ventral scale and more pronounced toward the posterior part of the body.

I follow Van Denburgh in referring the *Crotalus* of this region to *oregonus* Holbrook. (See Van Denburgh, 1912.)

Habits.—This individual was found among volcanic boulders on a hillside. Its stomach contained an adult ground squirrel, *Citellus mollis*.

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ON SOME GENERIC NAMES FIRST MENTIONED IN THE "CONCHOLOGICAL ILLUSTRATIONS."

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In reviewing the Fissurellidae of the Pacific coast of North America I found some confusion existing in the synonymy of several well-known species and genera, the clearing up of which may have some interest for students.

The following data will serve toward that end:

Genus LUCAPINA (Gray) Sowerby, 1835.

Lucapina (elegans) GRAY, in Sowerby, Conch. Ill., *Fissurella*, p. 4, No. 38, fig. 29, June, 1835; as synonym of *F. cancellata* Sowerby, Conch. Ill., p. 4 (as of Solander MS.)

Lucapina PHILIPPI, Test. Utr. Sicil., vol. 2, 1844, p. 90, cites *cancellata* Sowerby, as type and sole species mentioned.

Lucapina (Gray) HERRMANNSEN, Index Gen. Mal., vol. 1, p. 627, 1846; cites *Fissurella cancellata* as type.

Lucapina GRAY, Syn. Cont. Brit. Mus., ed. 42, p. 147; nude name under Fissurellidae, no species cited; ed. 44, 1840, p. 114 (ed. 44 A., 1840, p. 117), one line of diagnosis, no species cited.

Lucapina GRAY, Proc. Zool. Soc., 1847, p. 147, No. 160, cites *Fissurella aperta* Sowerby, and *L. elegans* Gray.

Lucapina (Gray) HERRMANNSEN, Index Gen. Mal., Suppl., p. 76, 1852, cites *Fissurella aperta* Sowerby, following Gray in Proc. Zool. Soc., 1847.

Lucapina GRAY, in M. E. Gray, Fig. Moll. An., vol. 4, p. 92, 1850, cites *L. cancellata* and *L. crenulata*, nude names, as examples.

Foraminella (Guilding MS.) SOWERBY, Conch. Ill., p. 4, No. 38, June, 1835, as *Foraminella sowerbii* Guilding, MS.; St. Vincent, West Indies. This name precedes *Lucapina* in the text, and is cited as a synonym of *Fissurella cancellata* Sowerby, Conch. Ill., p. 4,

Foraminella GUILDING, Cat. Conch. Nom., 1845, according to Agassiz in Scudder, Nomencl. Zoologicus, p. 139, 1882.—CATLOW, Conch. Nomencl., p. 102, No. 11, 1845; cites from Sowerby, Conch. Ill., 1835. Not *Foraminella* Leven. Brach. 1902.)

Lucapina H. and A. ADAMS, Gen. Rec. Moll., vol. 1, p. 447, 1854; examples figured *L. reticulata* Donovan and *L. crenulata* Sowerby; vol. 2, p. 630, 1858, notes segregation of subgenus *Glyphis* Carpenter, and cites *G. inaequalis* as sole example, also *Capiluna* Gray, as synonym.

Lucapina WOODWARD, Manual, p. 150, 1852, *F. elegans* Gray, sole example cited; but it is confused with *F. crenulata* Sowerby, from which the diagnosis is drawn.

Glyphis CARPENTER, Mazatlan Cat., p. 220, 1856; first species *Fissurella inaequalis* Sowerby. (Not *Glyphis* Agassiz, 1853.)

Capiluna GRAY, Guide Moll. Brit. Mus., p. 166, 1857. *C. cuvieri*, sole example.

Lucapina GRAY, Guide Moll. Brit. Mus., p. 166, 1857. *L. cancellata* and *L. crenulata* cited.

Lucapina TRYON, Struct. and Syst. Conch., vol. 2, p. 326, 1883, *L. crenulata* cited as example.—FISCHER, Man. de Conchyl., p. 858, 1885, same type; as subgenus of *Fissurellidea* Orbigny, 1839.

Chlamydoglyphis PILSBRY, Man., pp. 198, 200, 1890. Type, *Lucapina adspersa* Philippi, 1845=*cancellata* Sowerby, 1835.

The name *Lucapina* (Gray, MS.) was first put in print by Sowerby, in his monograph of *Fissurella* in the Conchological Illustrations. In this work he had the cooperation of Doctor Gray and so states, so that the authenticity of the reference is certain. The citation of the manuscript name of Gray is preceded in the same paragraph by another, *Foraminella* of Guilding, founded on the same type. As the first reviser, Philippi, accepted *Lucapina* and not *Foraminella*, the former will take precedence. In the "Synopsis of the Contents of the British Museum," 1840, Gray gives as a diagnosis of this genus "in *Lucapina* the mantle covers the cancellated shell." It is evident that when Gray proposed the genus he conceived of it as a *Fissurella* in which the mantle covered all or a part of the outside of the shell and the anal foramen was rounded or oval. When Carpenter separated the genus *Glyphis* he included in it those species previously placed by Gray and the brothers Adams in *Lucapina*, which had the rounded foramen, but in which the mantle did not exceed the margin of the aperture as required by Gray's diagnosis. It is obvious that, according to the rules, no species can be selected as type which was not mentioned in the original publication. This restricts our search for a type to *Fissurella elegans* Gray, or its equivalent, *F. cancellata* Sowerby. The latter name being the only species mentioned, becomes the monotype. This view was accepted by Philippi, 1844, Herrmannsen, 1846, and many others. It now remains to discover what is the proper specific name to be retained for this species. There was an earlier *Fissurella cancellata* Gray, of 1825, so the specific name of Sowerby can not be retained. The specific name of *sowerbii* Guilding precedes in the text that proposed by Gray and must be adopted. It now remains to identify the species, which from Sowerby's excellent figure is not difficult. It is the West Indian shell commonly known as *adspersa* Philippi, 1845, *aegis* Reeve, 1850, and probably *lentiginosa* Reeve, 1850. Specimens in the Smithsonian collection, received from the 1839 collections of Dr. L. Pfeiffer in Cuba, through Thomas Bland, were labeled "*fasciata* Pfr." and the writer used that name in several papers; but a search for the place of publication proving fruitless, it seems probable that the name was inedited. Pilsbry noted the resemblance of Sowerby's figure to *adspersa*, but was apparently misled by the fact that Reeve in the Iconica, 1849, figured under the name of *cancellata*, another species which he afterward

called *hondurasensis* and *suffusa*; and the younger Sowerby in the Thesaurus confused together these two and the analogous species (*F. inaequalis* Sowerby?) of the Pacific coast.

The species *aperta* Sowerby (= *hiantula* Lamarck) in the Conchological Illustrations is the type of *Pupillaea* Gray,¹ and could not, therefore, be utilized as a type for *Lucapina* in spite of Gray's associating them in 1847. The same is true of *Fissurella crenulata* Sowerby, which he placed with *cancellata* in 1857. Yet, owing to Carpenter's action in segregating *Glyphis* without determining the matter of priority, it has come about that later authors, including the usually accurate S. P. Woodward, have regarded *Fissurella crenulata* Sowerby, 1825, as the type of *Lucapina*, though it was not mentioned in that connection until years after the first publication of the name. The confusion with the name *cancellata* Gray (not Sowerby), which is the same as *Patella graeca* Pennant and Montagu (not Linnaeus), as *apertura* Montagu (not Born), as *reticulata* Donovan (not of Bolten), and is not *cancellata* Gmelin, is responsible for Donovan's name getting into the synonymy.

This state of affairs leaves the large and beautiful *Fissurella crenulata* of Sowerby, so well known on the Pacific coast, without a valid generic name. For this I propose the name *Macrochasma* in allusion to the large anal foramen.

Another monotypic generic name appears in the Conchological Illustrations, *Macroschisma* Gray, founded on *Patella macroschisma* Solander, from Japan, and another species from Australia. The latter is not named and was regarded by Sowerby as a variety of the Japanese shell.

From the examination of a large number of specimens from the University of Tokio it seems probable that individual variation in this species is great enough to cover several of the species which have been described from Japan.

Machrochisma Swainson² is founded on the *Fissurella macroschisma* of Sowerby's Genera of Shells (fig. 5), which the latter author supposed to be identical with *F. hiantula* Lamarck; Sowerby's shell hardly differs from the typical *Macroschisma*, with which it probably should be united.

Pupillaea Gray also appears for the first time in the Conchological Illustrations, cited from the unpublished notes of Doctor Gray on the Mollusca of Beechey's Voyage. It is founded on *Fissurella aperta* Sowerby, 1825, which, like the earlier name *hiantula* Lamarck, 1822, was based on Born's vignette figure F, on page 414 of the Museum Vindobonense. All the shells of the various species of this group are remarkably similar in shape, color pattern, and sculpture. Until the animals have been carefully compared no final

¹ Conch. Ill. *Fissurella*, p. 2, No. 12, 1834.

² Mal., p. 356, 1840.

decision can be had as to their relations and the number of valid groups. Since Sowerby's shell is stated to have come from South Africa, there can be little doubt that the identification of Krauss is correct. It is in the highest degree improbable that Meuschen in 1782 had any opportunity of knowing the very rare Magellanic species called *megatrema* by Orbigny; but South African shells were then abundant in Europe, owing to the trade with the Indies by way of the Cape of Good Hope.

Doctor Pilsbry in the Manual places *hiantula* (= *megatrema*) under *Fissurellidea*; *aperta* Sowerby, under *Pupillaea*; *scutellum* (Meuschen) Gmelin, under *Megatebennus* subgenus *Amblychilepas*; with reasonable justification, but the bare shells, especially if a little worn, can hardly be told apart.

The last genus of the group referred to is *Cemoria*, cited from Leach's proof sheets, but luckily anticipated by Lowe's *Puncturella*, based on *F. noachina* of Linnaeus.

DESCRIPTION OF NEW SPECIES OF CRANE-FLIES FROM CENTRAL AMERICA.

By CHARLES P. ALEXANDER,
Of Cornell University, Ithaca, New York.

The following crane-flies are among the new species included in the extensive collections of Central American insects in the United States National Museum in Washington. They were sent to me to be named through the kindness of Mr. Frederick Knab, the custodian of Diptera.

This paper is a contribution from the entomological department of Cornell University.

Family TIPULIDAE.

Subfamily LIMNOBINAE.

Tribe LIMNOBINI.

Genus PERIPHEROPTERA Schiner.

Peripheroptera SCHINER, Verh. zool. bot. Ges. Wien, vol. 16, 1866, p. 933.

PERIPHEROPTERA OLIVIAE, new species.

Thorax reddish; wings yellowish, the veins seamed with brown.

Female.—Length about 5.2 mm.; wing, 7 mm.

Rostrum and palpi brownish black. Antennae broken. Head dark reddish brown.

Thorax reddish chestnut without black markings. Halteres dark brown, the stem a little paler. Legs with the coxae and trochanters reddish yellow, femora reddish brown, the tip broadly black, tibiae brown passing into dark brown at the tip, tarsi dark brown. Wings light yellow, all the veins, cross-veins, and deflections of veins seamed with brown, the stigma large, rectangular, apex of the wing narrowly brown, a large rounded brown mark at the arculus and a smaller one at Sc_2 ; the brown seams to the principal veins are less distinct before their forks, very heavy in the distal part of the wing. Venation as in fig. 1. Cell R_5 with its base distad of the bases of cells R_3 and 1st M_2 , cross-vein $r-m$ very short, cell 1st M_2 rather small and square, basal deflection of Cu_1 before the fork of M .

Abdomen short, the tergites chestnut, black laterally before and behind the sutures, the tip of the abdomen black, sternites reddish chestnut.

Habitat.—Panama.

Holotype.—Female, Porto Bello, Panama, March 13, 1913, Aug. Busck, coll.

Type-specimen.—Cat. No. 18496, U. S.N.M.

In my key to the species of *Peripheropectera*¹ this species would run down to *P. arcuata* Alexander of Peru. *P. oliviae* has the wing veins strongly seamed with brown, the basal deflection of Cu_1 before the fork of *M*, etc.

Tribe ANTOCHINI.

Genus TEUCHOLABIS Osten Sacken.

Teucholabis OSTEN SACKEN, Proc. Acad. Nat. Sci., Phila., 1859, p. 223.

TEUCHOLABIS COCKERELLAE, new species.

Head gray; color yellow with three shining black marks on the thoracic dorsum; wings yellow with three brown bands.

Male.—Length, 5.4 mm.; wing, 6.8 mm.

Rostrum and palpi yellow. Antennae brown at the base, flagellum broken. Head gray.

Thorax light yellow, the praescutum with three shiny black marks of which one is median, linear, broadest in front; lateral marks large, rounded; scutum and hinder margin of the praescutum very light yellow, each scutal lobe more reddish yellow in the middle; scutellum and anterior half of the postnotum very light yellow, the latter darker behind. Pleurae light yellow with slightly darker blotches. Halteres light yellow. Legs with the coxae and trochanters yellow, femora yellow with the tip broadly dark brown, tibiae brownish yellow, dark brown at the tip, tarsi yellowish brown, the apical segments dark brown. Wings broad, yellow, the tip narrowly brown, a broad brown cross-band at the cord, this mark entirely traversing the wing, a rounded brown blotch near the wing-base; veins yellow, darker in the brown marks. Venation as in figure 2.

Abdomen rich yellow throughout.

Habitat.—Guatemala.

Holotype.—Male, Quirigua, Guatemala, Mrs. W. P. Cockerell, coll.

Type-specimen.—Cat. No. 18497, U.S.N.M.

TEUCHOLABIS BUSCKI, new species.

Chestnut and black; wings whitish with sparse brown markings; basal deflection of Cu_1 far before the fork of *M*.

Male.—Length, 8.4–9.6 mm.; wing, 6.4–6.8 mm.

¹ Ent. News, vol. 24, p. 409.

Rostrum bluish black at the tip, light brown basally, palpi black. Antennae brownish black, the flagellar segments rounded oval. Head reddish chestnut, darker on the middle of the vertex.

Thoracic dorsum dark chestnut with three black stripes, the median one longest, the lateral stripes very indistinct, clearer behind; the region near the transverse suture including the posterior part of the praescutum and the anterior part of the scutum light yellow; scutum trivittate with black; scutellum and postnotum chocolate brown, more yellowish on the sides. Pleurae reddish yellow. Halteres brown. Legs with the coxae and trochanters reddish, femora dark brown, pale yellowish at the base, tibiae and tarsi black. Wings whitish hyaline with small brown marks at the origin of *Rs*, on cross-vein *r*, along the cord, on the basal deflection of *Cu*₁ and along the outer end of cell 1st *M*₂. Venation as in figure 3; basal deflection of *Cu*₁ far before the fork of *M* about underneath the middle of *Rs*.

Abdomen long, slender, black, the caudal portions of the segments chestnut-yellow, seventh segment mostly chestnut, the hypopygium black.

Habitat.—Panama.

Holotype.—Male, Porto Bello, Panama, March 4, 1911, Aug. Busck, coll.

Paratypes.—Five males, topotypic, same date and collector.

Type-specimen.—Cat. No. 18498, U.S.N.M.

Genus ORIMARGA Osten Sacken.

Orimarga OSTEN SACKEN, Mon. Dipt. N. Amer., vol. 4, 1869, p. 120.

ORIMARGA NIVEITARSIS, new species.

Black with two silvery lateral stripes on the thorax, tips of the tarsi white, wings unspotted.

Male.—Length, about 5.8–6 mm.; wing, 4.6 mm.

Female.—Length, about 6.8–7 mm.; wing, 4.4 mm.

Rostrum, palpi, and antennae black. Front narrowly silvery between the eyes, remainder of head grayish.

Thoracic dorsum black, shiny; the lateral margin of the praescutum up to the wing-root narrowly silvery. Pleurae black with a conspicuous silvery mark, narrowest in front, broader behind. Halteres light brown, knob darker. Legs with the coxae and trochanters dull yellow, femora dark brown lighter on the basal half, tibiae dark brown, tarsi, segment 1 with the basal two-thirds dark brown, remainder of the tarsi white except the terminal segment and claw which are darker. Wings hyaline, veins dark brown, distinct. Venation as in figure 5.

Abdomen dark brownish black.

Habitat.—Panama.

Holotype.—Female, Porto Bello, Panama, November, 1913, Dr. E. Martini, coll.

Allotype.—Male, topotypic.

Type-specimen.—Cat. No. 18499, U.S.N.M.

Tribe **ERIOPTERINI**.

Genus **MONGOMA** Westwood.

Mongoma WESTWOOD, Trans. Ent. Soc. Lond., 1881, p. 364.

MONGOMA METATARSATA, new species.

Cross-vein *r* just before the fork of $R_2 +_3$; wings subhyaline, stigma small, rounded; legs black with the base of the tibia and the tip of the femur narrowly white; tibia broadly tipped with white; all of the metatarsi black at the base, remainder of the tarsi white.

Female.—Length, 8.4 mm.; wing, 7.3 mm. Fore leg, femur, 11.6 mm.; tibia, 11.7 mm.; tarsus, 9.8 mm. Middle leg, femur, 11.7 mm.; tibia, 10.6 mm.; tarsus, 8.2 mm. Hind leg, femur, 11.3 mm.; tibia, 11 mm.; tarsus, 7.7 mm.

Rostrum and palpi brown. Antennae with the basal segment brownish, the remainder of the organ brownish black; constrictions between the segments of the flagellum not very distinct. Head yellowish brown.

Thorax dull yellowish brown with an indistinct median brown stripe behind; scutum with the lobes indistinctly brown, the median area paler, scutellum and postnotum brown. Pleurae brownish yellow, the sternum yellow. Halteres short, brown. Legs with the coxae and trochanters dull brown, femora brown, darkening toward the tip, the tip broadly white; tibiae with a basal white ring subequal in width to the apical femoral annulus; tip of the tibiae with the apical quarter white, remainder black; metatarsus with the basal quarter black, remainder of the tarsi white. Wings subhyaline, the stigmal spot small, dark brown; veins brown. Venation as in figure 6.

Abdominal tergites dark brown, lateral margins of the sclerites yellow, broadest on the first segment, becoming indistinct about mid-length of the organ; sternites brownish yellow.

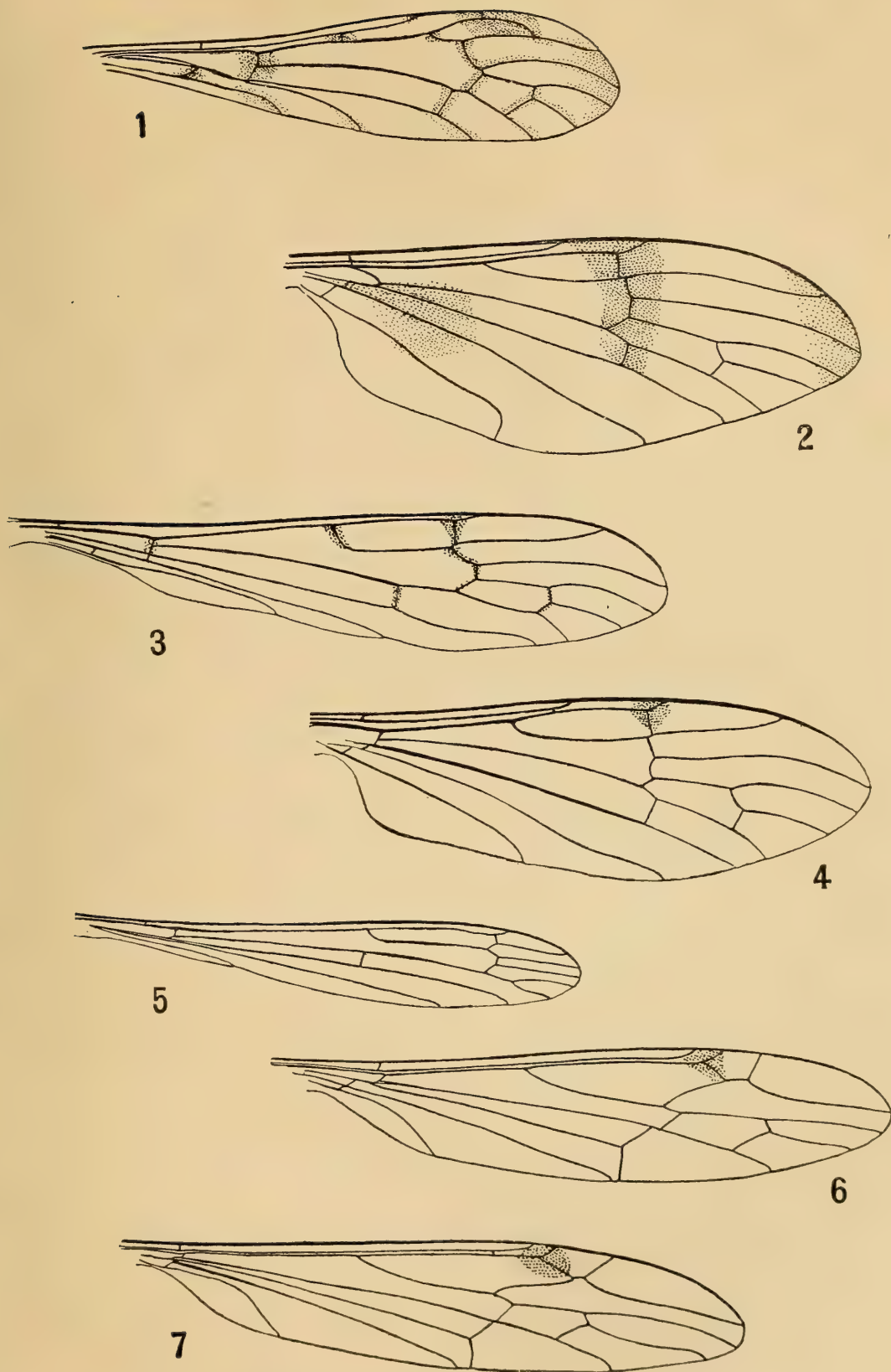
Habitat.—Panama.

Holotype.—Female, Trinidad River, Panama, May, 1911, Aug. Busck, coll.

Type-specimen.—Cat. No. 18500, U.S.N.M.

EXPLANATION OF PLATE 24.

- Fig. 1. Wing of *Peripheroptera oliviae*, new species.
2. Wing of *Teucholabis cockerellae*, new species.
3. Wing of *T. buscki*, new species.
4. Wing of *T. pleuralis* Alexander.
5. Wing of *Orimarga niveitarsis*, new species.
6. Wing of *Mongoma metatarsata*, new species.
7. Wing of *M. leucoxena* Alexander.



WINGS OF NEW SPECIES OF CRANE-FLIES.

FOR EXPLANATION OF PLATE SEE PAGE 444.

SYNOPSIS OF THE SPECIES OF SAWFLIES BELONGING TO
THE GENUS DIMORPHOPTERYX.

By S. A. ROHWER,

Of the Bureau of Entomology, United States Department of Agriculture.

The North American species belonging to the genus *Strongylogaster* and to the section *pinguis* in Norton's classification were made into a genus by Ashmead in his synopsis of the genera of sawflies. For a number of years all the species belonging to this genus had been assembled under one name, and biological notes on some of them published under that name. In 1910 *melanognathus* was described from one specimen from New Brunswick, Canada, and in 1911 Rohwer¹ tabulated the species and characterized certain forms as varieties. Recent rearings and more careful study of the adult brought three new species to light and also emphasized the specific identity of the forms treated as varieties in the last-mentioned paper.

This paper is a contribution from the Branch of Forest Insects, Bureau of Entomology.

Key to the species.

- Scutellum strongly convex; transverse radius wanting; mesoprescutum rufous; basal plates pale.....*abnormis* Rohwer, p. 446.
- Scutellum not strongly convex; transverse radius present; mesoprescutum black; basal plates black or brown..... 1.
1. Four apical abdominal segments black; (mandibles, antennae, clypeus and labrum black).....*melanognathus* Rohwer, p. 446.
- Abdomen beyond basal plate pale except sometimes sheath is black..... 2.
2. Females (scutellum yellow) 3.
- Males (scutellum usually black, though in one case, yellow) 7.
3. Apical margin of the clypeus depressed; (clypeus subsquarely emarginate; lobes rectangular; the anterior margin pale; four anterior femora pale).
errans Rohwer, p. 446.
- Apical margin of the clypeus not depressed..... 4.
4. Anterior margin of the clypeus arcuately or subangulately emarginate; lobes triangular..... 5.
- Anterior margin of the clypeus subsquarely emarginate; lobes rectangular..... 6.
5. Antennae black; ocellar basin just below the ocellus shining, evenly concave, fanshaped.....*virginica* Rohwer, p. 446.
- Antennae pale; ocellar basin just below the ocellus with a furrow in the center.
pinguis (Norton), p. 447.

¹ Proc. U. S. Nat. Mus., vol. 41, p. 403, etc.

6. Anterior margin of the clypeus yellowish; antennae piceous; mesepisternum with a pale spot basally; tibiae black apically.....*autumnalis* Rohwer, p. 447.
Clypeus black; antennae black; mesepisternum black; apex of the posterior tibiae black.....*castaneae* Rohwer, p. 447.
7. Fifth to eighth antennal joints without a ventral apical curved projection; post-ocellar area and area latrad of the lateral ocelli without large punctures; (clypeus shining, subangulately emarginate; supraclypeal area convex, not moundlike; lower angle of cheek not produced).....*virginica* Rohwer, p. 446.
Fifth to eighth antennal joints with a curved ventral apical projection; postocellar area and area latrad of the ocellus with large punctures..... 8.
8. Scutellum with a pale spot; apical margin of the clypeus pale; antennae entirely pale; lower angle of cheek not produced; (clypeus broadly subsquarely emarginate; lobes truncate; supraclypeal area convex).....*quercivora* Rohwer, p. 448.
Scutellum black; apical margin of clypeus black; antennae, except apices, piceous; lower angle of cheek produced..... 9.
9. Supraclypeal area flat; wings dusky; apical sternite black.....*errans* Rohwer, p. 446.
Supraclypeal area convex, in general outline triangular; wings hyaline; apical sternite rufous.....*castaneae* Rohwer, p. 447.

DIMORPHOPTERYX ABNORMIS Rohwer.

Dimorphopteryx abnormis ROHWER, Proc. U. S. Nat. Mus., vol. 41, 1911, p. 406.

This species is remarkable in the convex scutellum and the loss of the transverse radius.

DIMORPHOPTERYX MELANOGNATHUS Rohwer.

Dimorphopteryx melanognathus ROHWER, Proc. U. S. Nat. Mus., vol. 39, 1910, p. 205; vol. 41, 1911, p. 405.

The description of this species, dealing with the clypeus, may be elaborated as follows: Clypeus deeply, arcuately emarginate, almost subangular; lobes broadly triangular; supraclypeal area flat except a small rounded median tubercule.

DIMORPHOPTERYX ERRANS Rohwer.

Strongylogaster pinguis DYAR, Trans. Amer. Ent. Soc., vol. 22, 1895, p. 311; Journ. N. Y. Ent. Soc., vol. 5, 1897, p. 199 probably.

Parasiobla rufocinctus HOWARD, Insect Book, 1904, pl. 14, fig. 26.

Dimorphopteryx pinguis errans ROHWER, Proc. U. S. Nat. Mus., vol. 41, 1911, p. 406.

As far as I am able to ascertain from the published records the host plants of this species are black oak, birch, and linden. It may be that in Dyar's rearing he had more than one species included. As far as recent rearings are available no species has more than one host plant, and all the larvae belonging to this genus are so similar superficially that field determinations or determinations not based on adults can not be relied upon.

This species is known from New York State only.

DIMORPHOPTERYX VIRGINICA Rohwer.

Dimorphopteryx pinguis virginica ROHWER, Proc. U. S. Nat. Mus., vol. 41, 1911, p. 406.

This may be considered as a good species. The following characters will aid in the identification. Lobes of the clypeus about twice as

long as the basal width, their apices, obtusely triangular; four anterior femora yellowish or reddish; transverse radius received basad of the middle of the cell.

DIMORPHOPTERYX PINGUIS (Norton).

Allantus pinguis NORTON, Boston Journ. Nat. Hist., vol. 7, pt. 2, 1860, p. 244.

Strongylogaster pinguis NORTON, Catalogue, p. 150.

Dimorphopteryx pinguis ASHMEAD, Can. Ent., vol. 30, 1898, p. 308.—ROHWER, Proc. U. S. Nat. Mus., vol. 41, 1911, p. 405.

The type-specimen of this species is lost, but a neotype is in the United States National Museum.

MacGillivray¹ says that Provancher's *Sciapteryx punctum* is the female of this species. I have not examined the Provancher type, but accept the synonymy. Some of Doctor Dyar's rearings may refer to this species, but some of them refer to *errans*. If all other of Doctor Dyar's rearings refer to *errans*, the host plants of *pinguis* are *Amelanchier canadensis* and Maple.

DIMORPHOPTERYX AUTUMNALIS, new species.

Female.—Length, 8 mm. Labrum broadly rounded apically; clypeus gently convex, sparsely punctured, the apical margin subsquarely emarginate, the lobes rectangular, about one-third as wide as the width of the emargination; supraclypeal area flat; area latrad of the ocelli, postocellar area and posterior orbits, shining, practically impunctate; ocellar basin with broad sloping walls, distinct furrow from the anterior ocellus to the ventral margin of the basin; postocellar furrow straight; third antennal joint one-third longer than the fourth; scutum and prescutum sculptured similarly; punctures of the scutellum large; sheath with dorsal margin straight, apical margin subtruncate, lower angle broadly rounded. Black; labrum, apex of the clypeus, posterior lateral margin of the pronotum, tegulae, scutellum, four anterior legs below the middle, the coxae, most of the posterior coxae, posterior trochanters and posterior tarsi, *white*; (the four anterior femora are slightly reddish); abdomen beyond the basal plates, posterior femora and tibiae and the antennae, castaneus; wings hyaline, iridescent, venation dark brown except the costa, which is reddish.

Falls Church, Virginia. Described from two females recorded under Bureau of Entomology Number Hopk. U. S. 10168, material collected by C. T. Greene and reared by William Middleton.

Type-specimen.—Cat. No. 18189, U.S.N.M.

DIMORPHOPTERYX CASTANAEAE, new species.

Female.—Length, 8 mm. Labrum long, broadly rounded apically; clypeus evenly convex, shining, with scattered, large, well-defined punctures, the apical margin subsquarely emarginate, the lobes rec-

¹ Can. Ent., vol. 40, 1908, p. 368.

tangular, about half as broad as the emargination; supraclypeal area flat; ocellar basin well defined by broad rounded walls sloping inwardly, elongate and confluent with the middle fovea, but deepest immediately in front of the ocellus; area latrad of the antennal furrows shining with widely scattered punctures; the postocellar furrow well defined, slightly curved anteriorly; postocellar area about one-fifth wider posteriorly, well defined; third antennal joint one-third longer than the fourth; sculpture of the thorax normal; sheath straight above, subtruncate apically, with the lower angle rounded. Black; labrum, tegulae, scutellum, apices of coxae, trochanters, four anterior tibiae and tarsi, posterior tarsi *whitish*; abdomen beyond the basal segments except the sheath, the posterior femora and tibiae except the apex of the latter, castaneus; wings hyaline, iridescent, venation dark brown.

Male.—Length, 7 mm. Labrum obtusely rounded apically, clypeus flat as in the female; head and thorax as in the female; hypopygium broadly rounded apically. Colored as the female except the scutellum is black; the apices of the posterior tibiae are hardly black.

Falls Church, Virginia. Described from two females and three males recorded under Bureau of Entomology Number Hopk. U. S. 10157*e, f, g, h*. Material collected and reared by W. Middleton and the author.

Type-specimen.—Cat. No. 18187, U.S.N.M.

DIMORPHOPTERYX QUERCIVORA, new species.

Male.—Length, 7 mm. Labrum strongly convex basally, apical margin subtruncate; clypeus gently convex, broadly subsquarely emarginate, lobes rectangular, about one-third as wide as the emargination; supraclypeal area gently convex; ocellar basin rather well defined by broad low walls, partly separated from the middle fovea; if the separation were complete it would be trapezoidal; the area latrad of the ocelli, the posterior orbits, the postocellar area with large, well-defined, scattered punctures; antennal furrows complete; postocellar furrow well defined; flagellum flat, second joint two-thirds the length of the first; scutum with punctures rather more dense than on the prescutum; punctures of the scutellum large; hypopygium broadly rounded apically. Black; labrum, anterior margin of clypeus, tegulae, spot on the scutellum, four anterior legs below the apices of the coxae, apices of the posterior coxae, trochanters *yellowish white*; abdomen beyond basal plates, posterior femora and tibiae castaneus; posterior tarsi, except the base of the first joint, pale ferruginous; wings hyaline, iridescent, venation black.

Tomahawk Lake, Wisconsin. Described from one male recorded under Bureau of Entomology Number Hopk. U. S. 10171, material collected by S. A. Rohwer and reared by William Middleton.

Type-specimen.—Cat. No. 18188, U.S.N.M.

FLOUNDERS AND SOLES FROM JAPAN COLLECTED BY THE UNITED STATES BUREAU OF FISHERIES STEAMER "ALBATROSS" IN 1906.

By CARL L. HUBBS,
Of Stanford University, California.

INTRODUCTION.

The present paper deals with the Heterosomata (flounders and soles) collected during the 1906 expedition of the United States Bureau of Fisheries steamer *Albatross* in Japan. Nine species are described as new, two representing genera which are apparently undescribed. A new generic name is proposed for *Engyprosopon iijimae* Jordan and Starks, and a rearrangement of several other genera has been found necessary. The flounders and soles obtained during this expedition by members detached to study the shore fishes have been reported on by Prof. J. O. Snyder.¹ The writer is indebted to Dr. C. H. Gilbert for opportunity to study this collection and for assistance and suggestions in the preparation of this report. He has been materially assisted by a comprehensive review of the flounders and soles of Japan, by Jordan and Starks.²

Measurements are expressed in hundredths of length from tip of snout to base of caudal, this length being expressed in millimeters. Under each species the stations at which the *Albatross* obtained the specimens are mentioned, together with the approximate locality. Following is a detailed list of these stations:

Abbreviations and symbols.

[* Signifies depth as shown by chart when no sounding was made. ** Signifies depth and character of bottom as obtained by sounding at previous station.]

The character of bottom is expressed by the following abbreviations:

bk.....black.	G.....gravel.	R.....rock.
bl.....blue.	Glob....globigerina.	rky....rocky.
br.....brown.	gn.....green.	S.....sand.
brk....broken.	gy.....gray.	Sh.....shells.
C.....clay.	hrd....hard.	sml. ...small.
Co.....coral.	lav....lava.	Sp.....specks.
crs.....coarse.	M.....mud.	St.....stones.
fne.....fine.	Oz.....ooze.	vol.....volcanic.
For....foraminifera.	P.....pebbles.	

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¹ Proc. U. S. Nat. Mus., vol. 42, 1912, pp. 438-441 and p. 517.

² Idem, vol. 31, 1906, pp. 161-246.

Stations.	Latitude N.	Longitude E.	Date (1906).	Fathoms.	Bottom character.
	° ' "	° ' "			
4807.....	41 36 12	140 36 00	July 16	44-47	Sh., crs. G.
4808.....	41 35 50	140 36 45	16	47	S., Sh., crs. G.
4812.....	38 33 00	138 40 00	18	176-200	fne. br. M.
4815.....	38 16 00	138 52 00	18	70	dk. gr. S.
4816.....	38 14 00	138 54 00	18	64	fne. gy. S.
4817.....	38 12 00	138 52 00	18	61	fne. gy. S.
4822.....	37 08 10	137 08 00	21	130	gn. M.
4826.....	37 25 30	137 32 00	21	114	fne. gy. S., bk. Sp.
4828.....	37 23 00	137 37 00	22	163	gn. M.
4832.....	36 14 30	135 56 30	23	76-79	dk. gy. S.
4834.....	36 03 30	135 54 00	23	130	gn. M.
4835.....	36 03 30	135 52 30	23	134	gn. M.
4838.....	35 56 30	135 39 15	24	144	gn. M.
4839.....	35 57 45	135 34 00	24	140	gn. M.
4842.....	36 13 00	133 27 00	26	82	fne. gn. S., Sh.
4843.....	36 29 20	133 01 20	26	100	gn. M., bk. S., Glob.
4844.....	36 34 00	132 50 20	26	116	gn. M., bk. S., Glob.
4855.....	36 01 30	129 42 00	30	70-89	gn. M.
8856.....	36 03 30	129 41 00	30	89	gn. M.
4858.....	36 17 00	129 40 00	31	67	gn. M., S., P.
4859.....	36 17 00	129 41 00	31	93	gn. M.
4868.....	36 32 00	139 45 00	Aug. 1	150**	gn. M., fne. gy. S.
4870.....	36 30 30	129 43 00	1	94**	60
4874.....	34 38 00	130 03 00	2	66	gn. S., brk. Sh.
4878.....	34 18 30	130 14 30	2	59**	
4884.....	32 32 00	129 30 45	8	53**	dk. gy. S., brk. Sh.
4885.....	32 31 30	129 30 15	8	53**	
4897.....	32 33 00	128 19 00	10	207	fne. gy. S., brk. Sh., For.
4927.....	29 57 00	130 41 00	14	-----	
4930.....	30 12 00	130 43 00	15	84**	brk. Sh., Co. P.
4931.....	30 12 00	130 43 40	15	83	brk. Sh., P., Co.
4932.....	30 29 30	130 45 00	15	-----	
4946.....	31 29 10	130 34 30	20	39	br. S., brk. Sh., P.
4947.....	31 28 20	130 35 30	20	51*	
4948.....	31 19 00	131 23 30	21	65	S., brk. Sh., P.
4961.....	34 09 15	134 56 40	27	33	fne. gy. S., M.
4962.....	34 08 00	134 56 20	27	36*	
4963.....	34 06 15	134 57 50	27	40*-37	
4964.....	34 05 30	134 56 40	27	37	fne. gy. S., M.
4982.....	43 00 00	140 10 30	Sept. 19	390-428	gn. M.
4983.....	43 01 35	140 10 40	19	428	gn. M.
4984.....	43 04 20	140 12 10	19	224-248	gn. M.
4985.....	43 05 20	140 15 15	19	224	gn. M. (?)
4986.....	43 01 40	140 22 40	19	172	fne. bk. S., bk. M.
4988.....	43 23 10	140 21 10	20	68	S.
4989.....	43 23 10	140 37 00	20	92	S.
4992.....	45 24 00	140 49 10	22	325**	gn. M. (?)
4993.....	45 25 30	140 53 00	22	142	gy. M., S., G.
4994.....	45 27 50	140 54 00	22	190	br. M., fne. bk. S.
4997.....	47 38 40	141 24 30	23	318	gn. M.
4998.....	47 39 10	141 31 40	23	66	br. M., fne. gy. S.
4999.....	47 38 20	141 39 00	23	31	gy. M., gn. S.
5000.....	47 37 30	141 42 30	23	31**	gy. M., gn. S. (?)
5001.....	47 35 00	141 43 00	23	30	gn. M., gy. S.
5002.....	47 33 30	141 45 00	23	30**	gn. M., gy. S. (?)
5003.....	47 32 30	141 45 00	23	35-38	fne. gy. S., gn. M.
5004.....	47 31 00	141 44 30	23	38	gn. M.
5005.....	46 04 40	142 27 30	24	42-43	gn. M., fne. gy. S.
5006.....	46 04 00	142 29 00	24	42-43	gn. M., fne. gy. S.
5007.....	46 03 00	142 31 00	24	42	gn. M., fne. gy. S.
5008.....	46 07 50	142 37 20	24	40	gn. M., fne. gy. S.
5009.....	46 24 10	142 40 00	24	25	gn. M.
5010.....	46 30 30	142 43 30	24	21-32	gn. M., S.
5011.....	46 18 30	143 05 40	25	42	gn. M.
5012.....	46 17 50	143 08 30	25	42**	gn. M. (?)
5013.....	46 17 00	143 09 00	25	43	(?)
5015.....	46 44 00	144 02 00	26	510	gn. M.
5019.....	46 40 15	144 00 00	26	192	br. M., bk. S., P.
5025.....	48 43 30	144 56 45	27	52	P.
5031.....	44 04 00	145 32 00	30	86	dk. S., G.
5041.....	42 16 30	142 04 00	Oct. 3	61-140	br. M., fne. bk. S., co. S.
5042.....	42 17 30	142 07 30	3	61	br. M., fne. bk. S., co. S.
5047.....	38 12 50	141 49 15	10	107	dk. gy. S., brk. Sh., P.
5066.....	35 06 05	138 40 20	15	211-293	fne. bk. S.
5067.....	35 05 50	138 41 15	15	293	bk. S., brk. Sh.
5071.....	35 03 10	138 49 50	15	57	M., S., brk. Sh.
5072.....	34 44 55	138 22 20	16	148-284	gy. M.
5074.....	34 40 45	138 16 15	16	47	gy. M.
5081.....	34 14 00	138 05 00	19	-----	
5092.....	35 04 50	139 38 20	26	70	crs. bk. S.
5094.....	35 04 42	139 38 18	26	88	bk. S., brk. Sh.

LIST OF SPECIES.

Notes are included concerning several species which were not obtained by the fisheries steamer *Albatross*. The names of these species are indicated by an asterisk in the following table.

Family PLEURONECTIDAE.

PSETTINAE.

1. *Chascanopsetta raptator*.*
2. *Citharoides macrolepidotus*, new genus and species.
3. *Arnoglossus japonicus*, new species.
4. *Psettina (iijimae)*, new genus.
5. *Platophrys myriaster*.*
6. *Engyprosopon xystrias*, new species.
7. *E. kobensis*.
8. *Laeops kitaharae*.*
9. *L. lanceolata*.*
10. *L. variegata*.*
11. *Laeoptichthys fragilis*, new genus and species.

HIPPOGLOSSINAE.

12. *Tarphops oligolepis*.
13. *Pseudorhombus cinnamomeus*.
14. *Pseudorhombus misakius*.
15. *Pseudorhombus ocellifer*.
16. *Xystrias grigorjewi*.
17. *Acanthopsetta nadeshnyi*.
18. *Hippoglossoides hamiltoni*.
19. *H. dubius*.
20. *H. propinquus*, new species.
21. *Cleisthenes pinetorum*.
22. *C. herzensteini*.
23. *Atheresthes evermanni*.

PLEURONECTINAE.

24. *Poecilopsetta plinthus*.
25. *Pleuronichthys cornutus*.
26. *Lepidopsetta bilineata*.
27. *L. mochigarei*.
28. *Limanda aspera*.
29. *L. sakhalinensis*, new species.
30. *L. asprella*, new species.
31. *L. korigarei*, new species.
32. *L. iridorum*.
33. *L. angustirostris*.
34. *L. yokohamae*.
35. *Liopsetta obscura*.
36. *L. glacialis*.

37. *L. pinnifasciata*.
38. *Dexistes rikuzenius*.
39. *Platichthys stellatus*.
40. *Kareius bicoloratus*.
41. *Clidoderma asperrimum*.
42. *Microstomus stelleri*.
43. *M. kitaharae*.
44. *Glyptocephalus ostroumowi*.

Family SOLEIDAE.

SOLEINAE.

45. *Aseraggodes kobensis*.

SYNAPTURINAE.

46. *Zebrias zebrinus*.
47. *Z. zebra*.*
48. *Z. quagga*.*
49. *Aesopia cornuta*.*

CYNOGLOSSINAE.

50. *Cynoglossus inusita*.
51. *Rhinoplagusia japonica*.
52. *Areliscus interruptus*.
53. *Symphurus hondoensis*, new species.
54. *S. orientalis*.

Family PLEURONECTIDAE.

Subfamily PSETTINAE.

CHASCANOPSETTA RAPTOR (Franz).

This species was described by Victor Franz¹ as *Trachypterophrys raptor*, new genus and species. *Trachypterophrys* is surely included in *Chascanopsetta* Alcock. *C. raptor* is related to *C. prorigera* Gilbert, from the Hawaiian Islands, differing in having fewer anal rays (77 instead of 89) and in having a longer, flatter arch in the lateral line, its length being 1.5 instead of nearly 2 in the head. *C. raptor* differs from *C. lugubris* Alcock,² the type-species, from the Bay of Bengal, in having the arch in the lateral line flat-topped (as in *C. prorigera*) instead of being angulated above the pectoral fin.

(No specimens were obtained by the *Albatross*.)

CITHAROIDES, new genus.

This genus is closely related to *Citharus* of Europe, resembling that genus very closely in the following characters:

Eyes and color on left side; mouth large and symmetrical, the mandible projecting; ventral bases nearly equal, the left on the pre-

¹ Abh. Bayer. Akad., 1910, p. 60, pl. 7, fig. 54.

² Journ. Asiatic Soc. Beng., vol. 63, 1894, p. 129, pl. 6, fig. 4.

anal ridge; origin of dorsal slightly on blind side, near anterior margin of upper orbit; dorsal and anal deflected to the blind side of the caudal peduncle, both fins high to their posterior ends; anal spine present, but weak; scales very large, weakly ctenoid; arch in lateral line long and angulated behind; upper orbit larger than the lower and anterior to it; gill-rakers slender; anus on eyed side in both genera, a character apparently peculiar to them, as in all other flounders examined the anus is on the preanal ridge or on the blind side.

Citharoides differs from *Citharus* in dentition, the vomer being toothless; and in the more regular jaw, the premaxillaries being much less prominent, the mandible anteriorly being flat, instead of strongly arched downward.

Type of the genus.—*Citharoides macrolepidotus*, new species.

CITHAROIDES MACROLEPIDOTUS, new species.

Plate 25, fig. 1.

Type-specimen.—Cat. No. 75670, U.S.N.M. A male 59 mm. long, from Albatross station 4874, in the eastern channel of the Korean Strait; depth, 66 fathoms; collected August 2, 1906.

Length of head, 0.29 of total length to base of caudal; depth, 0.37; dorsal, 66; anal, 45; 40 series of scales along the lateral line.

Head obtusely pointed, the profile only slightly elevated at a point above the anterior part of the upper eye; upper orbit, as in *Citharus linguatula*, larger and considerably anterior to the lower, the anterior margin of the lower eye only slightly anterior to the vertical of the anterior border of the upper pupil; diameter of each eye 0.08; eyes separated by an exceedingly narrow ungrooved ridge, which is not extended anteriorly nor posteriorly, its length about 0.05; nostrils as in *Citharus linguatula*, the anterior nostril with a short flap, the posterior nostril wide, its anterior wall within with a flap; snout somewhat rounded, its length 0.06; mouth large, symmetrical, and moderately oblique, the mandible projecting; length of maxillaries, 0.14, extended to below posterior margin of lower pupil; teeth symmetrically placed on jaws, those of upper jaw uniserial, with several enlarged teeth irregularly placed, those of lower jaw uniserial posteriorly, becoming biserial and finally forming a narrow band at symphysis; vomer and palatines toothless; a bony tubercle present at anterior end of arch in lateral line; 9 slender gill-rakers on lower limb of arch, their posterior edges serrate, 3 tubercles on upper limb, the longest gill-raker (the third from the angle of arch) about 0.03.

Body elliptical, the greatest width about 6 in the greatest depth; depth of caudal peduncle 0.12; caudal peduncle angulated above and below in cross section.

Scales weakly ctenoid and deciduous on the eyed side, cycloid on the blind side; snout and jaws naked; fins, except caudal at base,

also scaleless. Lateral line on both sides with a long arch, abruptly angulated, the portion behind angle steep; length of arch 0.17, eight-tenths of this length being the distance from the anterior end of arch to its angle.

Dorsal beginning at the vertical of the anterior border of upper eye, extended on the caudal peduncle, where it is deflected toward the blind side; anal similar, anal spine weak; dorsal and anal reaching their greatest height near posterior end, the third before the last dorsal ray longest, its length 0.13, the fourth before the last anal ray longest, 0.13; caudal slightly pointed or doubly truncate; pectoral of blind side well developed, with 9 rays, that of eyed side with 10 rays; ventrals as in *Citharus linguatula*; left ventral on preanal ridge, its base not extended, only slightly broader than the base of right ventral; ventral of blind side the longer, its length 0.13, length of left ventral 0.095; each ventral of 6 rays.

Color light brown in alcohol; edges of caudal peduncle, where the fins are deflected toward the blind side, with a pair of very dark brown spots (as in *Citharus linguatula*), a similar spot below the posterior end of the arch in the lateral line; slightly mottled elsewhere. Dorsal, anal, caudal, and left ventral spotted with the same color; pectorals and right ventrals colorless.

Paratype.—No. 22527, Stanford University Museum. A male, 57 mm. long, from the same locality as the type. Dorsal, 69; anal, 43; scales, 40; head, 0.30; depth, 0.42; diameter of upper eye, 0.09; length of interorbital ridge, 0.05; length of snout, 0.06; maxillary of eyed side, 0.15; gill-rakers, 3 + 10.

Only two specimens known.

ARNOGLOSSUS JAPONICUS, new species.

Plate 25, fig. 2.

This species has 64 scales along the lateral line, thus being intermediate between the large-scaled species and the type of *Anticitharus* with 75 scales (*Anticitharus debilis* Günther).¹ It differs from the only other known Japanese species, *Arnoglossus violaceus* Franz,² in the larger scales and fewer fin rays. *Arnoglossus violaceus* has dorsal, 115; anal, 92; scales, 100. *Arnoglossus tenuis* Günther, from Hongkong, China, has 48 scales in the lateral line. *A. cacatuæ* Ogilby, from Queensland has 64 scales in lateral line and 55 anal rays.

Type-specimen.—Cat. No. 75671, U.S.N.M. A specimen 106 mm. long, from *Albatross* station 4930, Vincennes Strait, south of Kiusiu, Japan, collected on August 15, 1906, at a depth of 84 fathoms.

Length of head, 0.28 of total length to base of caudal; depth, 0.40; dorsal, 97; anal, 74; scales in 64 series along lateral line.

¹ Shore Fishes, *Challenger*, p. 48, pl. 22, fig. 4.

² Abh. bayer. Akad., 1910, p. 61, pl. 7, fig. 56 (perhaps not an *Arnoglossus*).

Head moderate, subconic; no elevation of profile above upper eye; upper eye slightly posterior, its diameter 0.075; interorbital space narrow, naked only in its central portion, its ridge extended from the anterior margin of the lower orbit to the posterior margin of the upper orbit; nostrils in the same horizontal line, the anterior provided with a short acuminate flap; snout sharp, its length from upper orbit 0.09, its outline not parallel to anterior margin of lower orbit; mandible shorter than the upper jaw, anterior teeth of premaxillaries wholly without the mandibular symphysis; mandible and premaxillaries strongly curved, so that for their anterior third the cleft of the mouth is horizontal, for their posterior end the mouth is oblique; maxillary of eyed side 0.13, extending to below pupil of lower eye; ridges of head not sharply developed; no spines nor tubercles; teeth uniserial, developed equally on both sides of jaws, about 8 moderate canines on each side of mandible, which has no symphyseal knob; anterior end of premaxillaries produced and provided with 4 canines, the lateral teeth of upper jaw small and sharply conic, about 40 in number; vomer and palatines toothless; gill-rakers short, none on upper limb, 8 on lower limb, each curved strongly behind and provided with 3 spinules; length of longest gill-raker about 0.24 of the diameter of upper eye.

Body elliptical, compressed, the width about 7 in depth; depth of caudal peduncle 0.09. Anus on blind side.

Scales moderate, caducous, cycloid on both sides. Snout and jaws naked; pectorals and ventrals naked. Arch in lateral line rather low, its length 0.13, its height 0.05; no lateral line on blind side.

Dorsal fin originating slightly on the blind side, at the posterior end of the premaxillary spine, on a level with the lower margin of the upper orbit, its longest rays about 0.16; anal similar to dorsal; caudal sub sessile, rather pointed, length 0.18; anal spine absent, pubic spine present; pectoral of eyed side slightly pointed, with 13 rays, its length 0.15; pectoral of blind side shorter and more rounded, with only 10 rays, its length 0.09; each ventral of 6 rays; base of right ventral contained not quite two times in the base of left ventral.

Color very light in alcohol, with indications of darker mottling; all the fins dark or with dark spots, except the pectorals and the ventral of blind side.

Paratype.—No. 22528, Stanford University Museum.

From *Albatross* station 5074, in Suruga Gulf, Japan; depth, 47 fathoms. Length, 89 mm.; dorsal, 99; anal, 79; scales, 64; head, 0.26; depth, 0.38; eye, 0.075; snout, 0.08; maxillary, 0.10; pectoral of eyed side with 11 rays, its length 0.15; pectoral of blind side with 9 rays, its length 0.08.

A small specimen from the surface, Station 5081, off the east coast of central Hondo. Length, 41 mm. without caudal; dorsal, 98;

anal, about 76; scales, 63; head, 0.26; depth, 0.39; eye, 0.07; snout, 0.07; maxillary, 0.07; dorsal with 9 spots, anal with 7, with corresponding bars at bases of dorsal and anal; body spotted elsewhere.

Only these three specimens known.

PSETTINA, new genus.

A new generic name is here proposed for the species described as *Engyprosopon ijimae*, because the genus *Engyprosopon*, being characterized by a wide interorbital and two rows of teeth in the jaws, certainly does not include that species. The genus is closely related to *Arnoglossus*, differing from it in having ctenoid rather than cycloid, caducous scales; and in having a smaller mouth. *Psettina* differs from *Engyprosopon*, *Platophrys*, and related genera in the narrow interorbital, alike in both sexes; and in the uniserial teeth. It resembles *Engyophrys* from the Pacific coast of Colombia, South America, differing from that genus in having teeth on both sides of the jaws and in lacking the peculiar interorbital spine. The Australian genus *Lophonectes* differs chiefly in having the anterior dorsal rays much produced. The new genus may be described as follows:

Body sinistral, ovate, and compressed; mouth small but nearly symmetrical; teeth conic, slender, in a single series on both sides of jaws, none on vomer or palatines; head without spines, alike in both sexes, the interorbital a narrow ridge; ventrals very unsymmetrical; origin of dorsal low on snout; rays of dorsal and anal moderate, the fins extended to, but free from caudal; pectorals not filamentous; anal spine absent, pubic spine sharp, triangular; scales rather large, ctenoid on the eyed side, cycloid on the blind side; gill-rakers little developed; anus partly on blind side. No lateral line on blind side.

Type of the genus.—*Engyprosopon ijimae* Jordan and Starks.

PSETTINA IJIMAE (Jordan and Starks).

Engyprosopon ijimae JORDAN and STARKS, Bull. U. S. Fish Comm., vol. 22, 1902 (1904), p. 626, pl. 8, fig. 1. Suruga Bay.

One specimen from *Albatross* station 5074, Suruga Gulf; five specimens from *Albatross* station 4946, off the south coast of Kiusiu.

Table of measurements in hundredths of length to base of caudal.

<i>Albatross</i> station.....	5074	4946	4946	4946	4946	4946
Length to base of caudal, mm.....	79	97	92	91.5	72	69
Dorsal rays.....	90	89	95	92	92	87
Anal rays.....	73	68	73	73	72	68
Pores.....	46	43	52	55	54	53
Length head.....	25	25	26	25.5	27	25
Depth body.....	45	46	39	40	40	41
Diameter upper eye.....	8	8	8	8	8	8
Snout from upper orbit.....	7.5	8	8	8	7	7.5
Maxillary, eyed side.....	7	8.5	9	9	9	9.5
Pectoral, eyed side.....	15	17	14	16	16	17
Pectoral, blind side.....	10	11.5	10	10	9.5	10
Pectoral rays, eyed side.....	10	11	10	11	10	9
Pectoral rays, blind side.....	9	9	9	10	8	8
Gill-rakers.....	7	6	7	7	7	8

PLATOPHRYS MYRIASTER (Temminck and Schlegel).

?? *Platophrys circularis* REGAN, Trans. Linn. Soc., London, vol. 12, p. 26, fig. 3.—
V. FRANZ, Abh. bayer. Akad., 1910, p. 62, pl. 7, fig. 66.

The descriptions and figures of Regan and Franz both show clearly that they had larval forms of a *Platophrys*. Franz's identification, therefore, can not be accepted, and as his specimens agree with *P. myriaster* in the fin formula and in having minute scales, they may best be considered as the larval stage of that species.

Three larval specimens with symmetrical eyes and scaleless body; length to base of caudal 14, 18, and 22 mm. The largest has about 92 dorsal rays. Station 4927, surface, Vincennes Strait. Another specimen, with minute scales just developing, was captured at the surface, Station 4932, Vincennes Strait.

Genus ENGYPROSOPON Günther.

Contrary to the description of *Scaeops grandisquama* and *S. kobensis*, and of the genus *Scaeops*,¹ the teeth are not entirely uniserial, for closer examination shows that in those species they are biserial, as in *Platophrys*, and as usual in *Engyprosopon*. The gill-rakers vary from short and few, 0 + 5 to 7 in *E. grandisquama* and *E. kobensis*, to 2 + 14 slender ones (in *E. xystrias*), *E. hawaiiensis* and *E. xenandrus* from the Hawaiian Islands being intermediate. It is therefore impossible to separate *Scaeops* from *Engyprosopon*. *E. mogkii* (Bleeker), the type-species, is figured from a female specimen.

ENGYPROSOPON XYSTRIAS, new species.

Plate 25, fig. 3.

Type-specimen.—Cat. No. 75672, U.S.N.M. A female 69 mm. long from Albatross station 4931, Vincennes Strait, Japan, collected on August 15, 1906, at a depth of 83 fathoms.

This species differs from the two species of *Engyprosopon* previously known from Japan, *E. grandisquama* (Temminck and Schlegel) and *E. kobensis* (Jordan and Starks), in having a larger number of gill-rakers. *E. xystrias* has 2+14, *E. grandisquama* 0+5 or 6, and *E. kobensis* 0+7. It also differs in having the anterior premaxillary teeth protruding outside the symphysis of the lower jaw. Other differences are mentioned in the description. *E. xenandrus* Gilbert, from the Hawaiian Islands, has 12 gill-rakers on the lower limb of the first arch, and has uniserial teeth in the upper jaw. *E. spilurus* (Günther), from New Guinea, may be an allied species; it has dorsal, 90; anal, 66; scales, 47. In details of form, color, and scales, this species shows a remarkably close resemblance to *E. grandisquama*.

Length of head 0.25 of total length to base of caudal; depth, 0.53; dorsal, 89; anal, 68; series of scales, 35.

¹ Bull. U. S. Fish Comm., vol. 22, 1902 (1904), p. 627.

Head short, blunt, the profile very steep, slightly more so than in females of *E. grandisquama*; upper eye slightly posterior, its anterior border being on about the same vertical as the anterior edge of the pupil of the lower eye, diameter of upper eye 0.09; interorbital moderately wide, as usual in females of other species of this genus, interorbital width 0.06; nostrils as in *E. grandisquama*, closely approximated, the anterior with a short slender flap, the posterior very slightly tubular, slightly in advance of anterior margin of lower orbit; snout from upper orbit 0.12; maxillary of eyed side 0.10, reaching, as in *E. grandisquama*, a vertical slightly beyond the anterior margin of lower orbit; teeth strong and recurved, in a series similar on both sides of jaws, in addition to which a series of shorter, stouter teeth are developed outside of the main series; anterior end of premaxillaries with a few enlarged teeth, which are outside the mandibular symphysis when the mouth is closed, thus differing from *E. kobensis* and *E. grandisquama*, but resembling the species of *Arnoglossus*; vomer and palatines toothless; gill-rakers short and slender, 2+14 (no other species of Japanese *Psettinae* has gill-rakers on the upper limb of the arch; no other has more than 8 on the lower limb); a small tubercle present on the eyed side near tip of snout; lower margin of upper orbit and upper margin of lower orbit raised near center.

Form of body ovate, as in *E. grandisquama*; depth of caudal peduncle 0.11; width of body 6.5 in depth.

Scales ciliated or weakly ctenoid on eyed side, cycloid on blind side, large and caducous, as in *E. grandisquama*; only the tip of snout and jaws naked. Lateral line arched on eyed side, absent on blind side.

Origin of dorsal slightly on blind side, on a horizontal from upper margin of lower orbit; no anal spine, pubic spine sharp and triangular, as in related forms; caudal sub sessile, slightly pointed, its middle rays as long as head; pectoral of eyed side with 10 rays, its length 0.23; pectoral of blind side with 8 rays, its length 0.14; ventrals each of 6 rays, the base of right ventral about 0.3 base of left ventral.

Color as in *E. grandisquama*, with a similar pair of dark spots on caudal. "Light yellow spots bordered with darker in front of interorbital area." (Dr. C. H. Gilbert's color notes.)

Only the type-specimen known.

ENGYPROSOPON KOBENSIS (Jordan and Starks).

Scaeops kobensis (JORDAN AND STARKS) Proc. U. S. Nat. Mus., vol. 31, 1906, p. 170, fig. 2. Kobe.

Albatross station 4884 and 4885, near Nagasaki;

Albatross station 4930, Vincennes Strait.

This species shows marked sexual differences, indicated in the table following.

	Male.	Female.
Interorbital.....	One-half wider than upper eye.....	One-half as wide as eye.
Snout.....	Steeper; 1.5 in head.....	2.3 in head.
Ocular spines.....	Present.....	Absent.

E. kobensis differs considerably from *E. grandisquama* in the following characters:

	<i>E. kobensis.</i>	<i>E. grandisquama.</i>
Scales.....	54 to 56, firm and strongly ctenoid; fins more scaly.	35 to 36, caducous, weakly ctenoid.
First ray of pectoral in male.	Filamentous, much longer than the second ray, twice length of head.	Not filamentous, about equal to second, only slightly longer than head.
Form.....	Broadly elliptical.....	Ovate.
Nasal spine in male..	Strongly developed, entering into profile of head.	Weakly developed, not entering into profile of head.
Ocular spines about upper orbit in males consisting of	1 main spine, sharp, on median anterior margin, and a few elevations of lower ridge.	A single dull wide spine at anterior end of lower ridge, and a few tubercles posterior to this.
Ocular spines about lower orbit in males consisting of	A sharp spine directed forward at anterior end of upper ridge, 1 to 3 smaller spines on anterior ridge.	A single tubercular spine at anterior end of upper ridge.
Color.....	Darker brown, without caudal spots, snout of male spotted.	Lighter brown, caudal with 2 dark spots, 1 on upper and 1 on lower edge of fin; snout without dark spots.

The two adult males obtained have a roughly triangular dark area, which covers most of the blind side behind the pectorals.

The fifth specimen in the table shows that young males are similar to the females in measurements. This specimen also lacks the color on the blind side.

Dr. C. H. Gilbert, while in charge of the scientific work of the Japanese cruise of the *Albatross*, made these color notes on the first specimen in the following table:

Anterior half of interorbital space, in advance of a nearly vertical ridge between the eyes, marked with numerous fine yellow spots in nearly vertical series, and between these, parallel series of slightly larger blue spots. Similar spotting on anterior portion of dorsal fin. A few orange spots on ventral of colored side, and two larger orange spots on mandibular membrane of colored side. Greater part of blind side dark blue.

Table of measurements in hundredths of length to caudal base.

<i>Albatross</i> station.....	4885	4885	4930	4930	4930	4884
Sex.....	Male.	Female.	Male.	Female.	Male.	Female.
Length, mm.....	92	84	92.5	78	57.5	68
Dorsal rays.....	81	81	79	83	82	82
Anal rays.....	62	62	61	63	63	62
Pores.....	56	55	54	54	56	53
Length, head.....	25	25	25	25.5	26	26
Depth, body.....	52	49	51	52	47	49
Diameter, upper eye.....	7	8	8	8.5	8.5	8.5
Snout from upper eye.....	17	11	17	11	12	11
Maxillary, eyed side.....	7	7.5	7	7.5	8	8
Interorbital width.....	10	4	11	4.5	4.5	4
Pectoral, eyed side.....	28	28	49	34	27	26
Pectoral, blind side.....	12	12	14	11	11	10
Pectoral rays, eyed side.....	10	10	10	9	9	9
Pectoral rays, blind side.....	9	9	9	8	8	8
Gill-rakers.....	6	7	7	6	6	6

LAEOPS KITAHARAE (Smith and Pope).

Lambdopsetta kitaharae SMITH and POPE, Proc. U. S. Nat. Mus., vol 31, 1906, p. 496.

This species is referable to the genus *Laeops* Günther. The teeth of the jaws are in narrow bands, developed wholly on the blind side. No specimens were obtained by the *Albatross*.

LAEOPS LANCEOLATA Franz.

Laeops lanceolata FRANZ, Abh. bayer. Akad., 1910, p. 62, pl. 8, fig. 60. Fukuura; Dzushi.

L. lanceolata seems to differ from *L. kitaharae* in having more fin rays (dorsal, 109 to 115; anal, 88 to 95, rather than dorsal, 103; anal, 76); and in the smaller scales (120 rather than 100). Eye, 2.5, instead of $3\frac{1}{4}$.

No specimens were obtained by the *Albatross*.

LAEOPS VARIEGATA Franz.

Laeops variegata FRANZ, Abh. bayer. Akad., 1910, p. 63, pl. 8, fig. 59. Fukuura; Dzushi.

This may be a larval form. Franz states that he did not examine its dentition. Its generic identification is therefore doubtful. Its anterior dorsal rays are produced in front; dorsal, 110; anal, 90; scales, 110; eye, 6.5.

No specimens were obtained by the *Albatross*.

LAEOPTICHTHYS, new genus.

Body elongate-ovate, strongly compressed; eyes and color sinistral; mouth small, the jaws of the blind side strongly curved, the teeth in a single even series, confined entirely to the blind side of both jaws; interorbital a narrow ridge; ventrals very unsymmetrical, the left with a very broad base; origin of dorsal in advance of upper eye; rays of dorsal and anal numerous; no anal spine; scales very small, cycloid, lateral line with a high angular arch; gill-rakers rudimentary; anus nearly on preanal ridge.

Laeoptichthys differs from *Laeops* Gunther¹ in having the teeth in a single even row, rather than in narrow bands.

Type of the genus.—*Laeoptichthys fragilis*, new species.

LAEOPTICHTHYS FRAGILIS, new species.

Plate 26, fig. 4.

Type-specimen.—Cat. No. 75673, U.S.N.M. A specimen 68 mm. long, from *Albatross* station 5074, in Suruga Gulf, Japan; depth 47 fathoms, collected on October 16, 1906.

¹ *Challenger* Shore Fishes, vol. 1, 1880, p. 29.

Length of head, 0.19 of total length to base of caudal; depth, 0.31; dorsal, 109; anal, 90.

Head blunt and very short; elevation of upper profile at occiput abrupt; ventral outline of head evenly curved; the posterior angle of mandible not very prominent; diameter of upper eye, 0.05, equal in size to lower eye and slightly posterior to it; the eyes separated by a high naked ridge rising abruptly on preorbital at middle of anterior margin of lower orbit, extending backward and upward posterior to the upper orbit; nostrils closely approximated, the anterior lower than the posterior, with a short, fleshy, pointed flap, the posterior small, not tubular, and without flap; snout from upper orbit about as long as diameter of upper eye; a rectangular figure formed by the anterior margins of orbits, the outline of snout, and the premaxillaries; mouth very small and nearly vertical, the maxillaries reaching only to the vertical of the anterior margin of the lower eye; bones of eyed side nearly straight; those of blind side strongly curved; maxillary of eyed side not quite as long as snout; the region posterior to lower orbit deeply grooved; interorbital ridge very prominent; preopercular ridge prominent, curved to form a slight but regular arch, preopercle extended backward at angle, so that the posterior edge forms a semicircular arch; no spines or tubercles on head; teeth small and sharp, but little compressed antero-posteriorly, forming a single very even series confined entirely to the blind side of the jaws, not even extended to symphysis; gill-rakers rudimentary, about 6 of 7 papillae on lower limb of arch, none on upper limb.

Body very thin and very elongate-ovate, the greatest width only about 0.1 of depth. Dorsal outline more curved than ventral. Depth of caudal peduncle, 0.08. The body cavity extended only one-ninth the distance from the pectoral to the caudal base. Anus nearly on ventral ridge.

Scales cycloid, small, deciduous; 102 along the lateral line. Lateral line present on eyed side only, with a high, short, and angulated arch above pectoral; its length 0.10, its height 0.06; posterior to the arch the lateral line is straight and exactly median in position, extended on middle caudal ray. Head scaly, except on interorbital, snout and jaws; fins naked, excepting a few scattered scales on the base of dorsal, anal, and caudal.

Origin of dorsal slightly in advance of anterior margin of upper orbit, the first two rays separate, the fin high to posterior end, the highest ray, 0.13, the last ray about 0.07. Caudal sub sessile, length, 0.18. Anal similar to dorsal, the posterior rays crowded; anal spine absent. Ventrals each of six rays. Pectorals very small, pointed, length of pectoral of eyed side, 0.06, blind side, 0.05.

Color in alcohol, flesh-colored. Pectorals and ventral of blind side colorless, other fins dusky.

Paratype.—No. 22531, Stanford University Museum.

From *Albatross* station 5072, near locality of type. Length, 72 mm. Head, 0.19; depth, 0.33; upper eye, 0.06; pectoral of eyed side, 0.06; dorsal, 104; anal, 88.

Two specimens known.

Subfamily HIPPOGLOSSINAE.

Genus TARPHOPS Jordan and Thompson.

Tarphops JORDAN and THOMPSON, Mem. Carnegie Mus., vol. 6, No. 4, 1914.

Tarphops differs from *Pseudorhombus* in the large scales.

TARPHOPS OLIGOLEPIS (Bleeker).

Rhombus oligolepis BLEEKER, Vifde Bijdrag, Japan, p. 8, pl. 2, fig. 2. Nagasaki.

Pseudorhombus oligolepis JORDAN and STARKS, Proc. U. S. Nat. Mus., 1906, p. 179.

Albatross station 4884, near Nagasaki entrance.

Albatross stations 4961, 4962, and 4963, in Kii Channel, east of Shikoku Island.

Measurements in hundredths of length to base of caudal.

<i>Albatross</i> station.....	4884	4962	4963	4961
Length to base C., mm.....	52	47	50	48
Dorsal rays.....	65	64	66	68
Anal rays.....	51	51	51	53
Pores.....	47	45	49	53
Length, head.....	27	30	28	28
Depth, body.....	45	43	45	42
Diameter, upper eye.....	9	10	10	10
Snout from upper orbit.....	7	7	7	7
Maxillary, eyed side.....	12	14	14	13
Pectoral rays, eyed side.....	9	9	10	8
Pectoral rays, blind side.....	8	7	9	8
Gill-rakers.....	7+19	6+19	6+19	6+20
Length pectoral, eyed side.....	20	21	20	20
Length pectoral, blind side.....	13	14	14	13

PSEUDORHOMBUS CINNAMOMEUS (Temminck and Schlegel).

Rhombus cinnamomeus TEMMINCK and SCHLEGEL, Fauna Jap., Poiss., 1846, p. 180, pl. 93. Nagasaki.

Pseudorhombus cinnamomeus JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 174.

Rhombus oligodon BLEEKER, Verh. Bat. Gen., vol. 26, 1857, Nieuw. Nalez., Japan, p. 121 (Nagasaki); Natur. Tyds. Nederl., vol. 6, p. 419; Act. Soc. Ind. Ned., vol. 5, Japan, pl. 3, fig. 2.

Pseudorhombus oligodon JORDAN and EVERMANN, Proc. U. S. Nat. Mus., vol. 25, p. 365 (Formosa).—JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 177.

This species is characterized by the ctenoid scales of the lower side, as also described by Bleeker for *P. oligodon*. The figure given by Temminck and Schlegel evidently represents the body deeper than usual in any Japanese species, and too many teeth are shown. Temminck and Schlegel's description and plate give the color and length of maxillary (reaching to below posterior border of orbit) as in *P. oligodon* and not as in *P. misakius*.

PSEUDORHOMBUS MISAKIUS Jordan and Starks.

Pseudorhombus misakius JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 175, fig. 4.

Three specimens from Shimizu, one from Nanao, collected by the *Albatross*.

This species differs from *P. cinnamomeus* in having cycloid scales on the blind side, in the smaller mouth, and in the coloration; from *P. dupliocellatus* in the larger scales (98 in *P. dupliocellatus*); from *P. ocellifer* in the shorter, fewer gill-rakers; and from *P. arsius* (Buchanan Hamilton), recorded from Japan by Snyder,¹ in "the lack of a white bordered ocellus on the lateral line, fewer dorsal rays, and a somewhat more slender body."

PSEUDORHOMBUS OCELLIFER Regan.

Pseudorhombus ocellifer REGAN, Ann. Mag. Nat. Hist., 1905, p. 26. Kobe.—JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 178.

Albatross stations 5071 and 5074, Suruga Gulf.

Albatross stations 4884 and 4885, west coast of Kiusiu.

Measurements in hundredths of length to base of caudal.

<i>Albatross</i> station.....	5074	5071	4885	4885	4885	4884
Length in mm.....	64	143	81.5	74	72	95
Dorsal rays.....	73	71	72	72	72	76
Anal rays.....	54	55	53	55	54	55
Pores.....	77	74	72	74	73	73
Length, head.....	32	32	31	32	30	29
Depth, body.....	47	44	44	47	43	46
Diameter, upper eye.....	8	7	8	8.5	8	7.5
Snout from upper eye.....	7	8	7	8.5	8	7
Maxillary, eyed side.....	15	15	15	16	16	13
Pectoral, eyed side.....	18	18	19	19	18	18
Pectoral, blind side.....	13	14	12	13	13	12
Pectoral rays, eyed side.....	10	11	10	10	9	11
Pectoral rays, blind side.....	8	9	9	8	9	10
Gill-rakers.....	5+16	6+17	5+16	6+17	5+17	5+17

Genus XYSTRIAS Jordan and Starks.

Xystrias JORDAN and STARKS, Bull. U. S. Fish Comm., vol. 22, 1902 (1904), p. 623.

In the key to genera by Jordan and Starks,² the genera *Xystrias* and *Verasper* are separated from *Acanthopsetta* by having the "anal spine weak or obsolete." It is well developed in all three genera.

XYSTRIAS GRIGORJEWI (Herzenstein).

Hippoglossus grigorjewi HERZENSTEIN, Bull. Acad. Sci. Imp. Petersb., 1890, p. 134. Hakodate.

Verasper otakii JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1900, p. 378. Tokyo.

Xystrias grigorjewi JORDAN and STARKS, Bull. U. S. Fish Comm., vol. 22, 1902 (1904), p. 623.

¹ Proc. U. S. Nat. Mus., vol. 42, 1912, p. 439.
² Idem., vol. 31, 1906, p. 164.

Albatross stations 4807 and 4808, Tsugaru Strait, between Hokkaido and Hondo.

Albatross stations 4815, 4816, and 4817, near Sado Island, Sea of Japan.

Albatross station 4832, near Tsuruga, Sea of Japan.

Albatross station 4856, off east coast of Korea, Sea of Japan.

Albatross station 5069, Suruga Gulf.

Measurements in hundredths of length to caudal base.

<i>Albatross</i> station.....	5069	4856	4832	4817	4817	4816	4808	4808
Length to base caudal, mm. . .	230	175	157	163	98	161	172	170
Dorsal rays.....	88	87	90	85	85	90	92	91
Anal rays.....	67	68	70	68	67	68	73	68
Pores in lateral line.....	90	86	86	84	86	89	88	90
Length, head.....	26	27	26	27	27	26	26	27
Depth, body.....	37	38	37	36	37	36	37	37
Diameter, upper eye.....	6	7	7	7	7	7	7	7
Snout from upper orbit.....	6	6	6	6	6	6	6	6
Maxillary, eyed side.....	10	11	9	10	10	9.5	10	10
Pectoral, eyed side.....	13	13	12	12	12	13	13	13
Pectoral, blind side.....	10	10	10	10	10	10	9	9.5
Pectoral rays, eyed side.....	10	10	10	10	11	10	11	10
Pectoral rays, blind side.....	10	10	10	9	10	11	10	10
Gill-rakers.....	5+19	5+18	5+17	3+15	4+16	6+17	6+17	5+14

Genus ACANTHOPSETTA Schmidt.

Acanthopsetta SCHMIDT, Faune Mer. Och., 1903, p. 19.

Acanthopsetta is allied to *Verasper* and *Xystrias*, but differs from them and resembles *Hippoglossoides* in having a single series of teeth in both jaws, even to the symphysis; and in the longer lower arch in the lateral line. This genus is characterized by the scaly snout and eye ball.

ACANTHOPSETTA NADESHNYI Schmidt.

Acanthopsetta nadeshnyi SCHMIDT, Faune Mer. Ochotsk, 1903, p. 19; name only; Pisc. Mar. Orient., 1904, p. 237, pl. 5, fig. 1.—JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 187.

Numerous specimens were obtained at the following localities:

Albatross stations 4982, 4983, 4984, and 4985, west coast of Hokkaido (Yezo).

Albatross stations 4997, 4998, 4999, 5000, 5001, 5002, and 5003, Gulf of Tartary.

Albatross station 5010, Aniwa Bay, Sakhalin Island.

Albatross station 5015, off East coast of Sakhalin Island.

Albatross station 5031, Yezo Strait.

This species is here recorded for the first time since the types were taken.

The depth at which the specimens were obtained varies from 21 to 510 fathoms.

Description of an adult female, 304 mm. long:

Length of head, 0.28 of total length to base of caudal; depth, 0.48; dorsal, 74; anal, 57; pores, 83.

Head moderate, subconic, dorsal and ventral outlines of head nearly straight; upper eye slightly posterior to lower, diameter 0.07; interorbital narrow; the ridge high, its anterior end parallel to anterior margin of lower orbit, its posterior end nearly parallel to posterior margin of upper orbit; anterior nostril tubular, its edges somewhat puckered; snout pointed, its length 0.05, its profile at right angles to border of premaxillary; lower jaw slightly projecting, symphyseal knob developed; both jaws nearly straight, maxillaries of equal length, extending to below pupil, 0.10; teeth small, sharp, recurved, somewhat irregularly uniserial, none enlarged; gill-rakers 8 + 12, rather thick and fleshy, length of longest 0.03.

Body dextral; dorsal and ventral outlines both strongly and equally curved; depth of caudal peduncle 0.11, its length from posterior end of anal base 0.09.

Scales ctenoid everywhere, including all the fins, the eye-ball, the entire snout, excluding a small naked area about nostrils. Lateral line with a long, rather low arch, its height 0.05, its length 0.19, about eight rows of scales between its uppermost part and the horizontal.

Origin of dorsal over pupil, its highest rays near middle of body, their length 0.14; anal quite similar, its longest rays 0.13; caudal rounded, its length 0.23; anal spine strong; pectoral of eyed side 0.14, pointed; pectoral of blind side similar, but shorter, 0.10; right pectoral of 10 rays, left of 9 rays; ventrals symmetrical, the right 0.08, the left 0.09.

Color uniform dark brown on eyed side.

Measurements in hundredths of length to base of caudal.

<i>Albatross</i> station	5015	4997	4997	4997	4984	4983
Length to base caudal, mm.....	304	283	241	184	246	212
Dorsal rays.....	74	67	68	72	76	71
Anal rays.....	57	57	56	57	61	55
Pectoral rays, eyed side.....	10	10	9	11	9	-----
Pectoral rays, blind side.....	9	9	9	10	9	10
Ventral rays, eyed side.....	5	5	5	6	6	6
Ventral rays, blind side.....	6	6	6	6	6	6
Pores.....	83	74	75	74	75	74
Length, head.....	28	27	29	27	28	28
Depth, body.....	48	47	47	45	43	44
Diameter, upper eye.....	7	7	7	7	8	7
Snout from upper orbit.....	5	5	6.5	6	6.5	6
Maxillary, eyed side.....	10	9	10	9	10	9
Pectoral, eyed side.....	14	14	15	12	15	15
Pectoral, blind side.....	10	11	10	9	11	10
Ventral, eyed side.....	8	8.5	9	8	9	9
Ventral, blind side.....	9	9	9	9	9	9
Gill-rakers.....	8+12	7+10	8+11	-----	6+11	7+10

In young specimens the eye-ball, the pectoral, and the ventral of the eyed side are nearly naked; the other fins and the snout are more weakly scaled than in the adult.

Genus HIPPOGLOSSOIDES Gottsche.

Cynopsetta SCHMIDT, Faune Mer. Ochotsk, 1903, p. 19; no description.Key to the species of *Hippoglossoides*.

- a*¹. Dorsal, about 70 to 80; anal, about 50 to 60; gill-rakers, $x+10$ to 12.
*b*¹. Depth of body, $2\frac{1}{2}$; scales cycloid on blind side.....*robustus*.
*b*². Depth, 2.3 to 2.6; scales ctenoid on both sides of the adult.
*c*¹. Scales moderately rough; pectoral shorter than half the head, that of blind side naked in young and adult.....*propinquus*.
*c*². Scales everywhere very rough; pectoral longer than half the head; pectoral of blind side with ctenoid scales in adult.....*hamiltoni*.
*a*². Dorsal, about 80 to 90; anal, about 60 to 70.
*d*¹. Dorsal, 86 to 92; gill-rakers, $x+10$ or 11.....*platessoides*.
*d*². Dorsal, 79 to 89; gill-rakers, $x+12$ to 19.
*e*¹. Gill-rakers, $x+12$ to 16; canines more strongly developed; maxillary more strongly curved and irregular.....*dubius*.
*e*². Gill-rakers, $x+16$ to 19; canines weaker; jaws more regular....*elassodon*.

HIPPOGLOSSOIDES HAMILTONI Jordan and Gilbert.

Hippoglossoides hamiltoni JORDAN and GILBERT, Rept. Fur Seal Invest., vol. 3, 1899, p. 489, pl. 84.

Measurements in hundredths of length to caudal base.

			Types.	
	5011	5009	<i>hamiltoni</i>	<i>robustus</i>
<i>Albatross Station</i>	5011	5009		
Length to caudal base, mm.....	237	225	133	275 (with C.)
Dorsal rays.....	71	81	72	77
Anal rays.....	56	61	56	62
Pores.....	91	89	91	92
Gill-rakers.....	3-11	3-12	2, 3-11, 12	2, 3-11, 12
Length, head.....	28	28	27.7	31
Depth, body.....	41	40	41	47
Diameter, upper eye.....	6	6	8	4.5
Snout from upper orbit.....	5.5	5.5	5.5	.....
Maxillary, eyed side.....	11	11	12.5	11.2
Maxillary, blind side.....	12	12	14	.....
Pectoral, eyed side.....	15.7	14.4	21	12.5
Pectoral, blind side.....	15.3	13.2	15	.....
Ventral, eyed side.....	10	9.5	10.8	9.2
Length, caudal.....	21	21	24.7	.....
Height, dorsal.....	14	13	17	11.3
Height, anal.....	14	13	17	11

These specimens differ from the smaller type in having a shorter pectoral, and in having the pectoral of the blind side covered with ctenoid scales, it being naked in the type. The measurements of the type of *H. robustus* Gill and Townsend,¹ made by Dr. C. H. Gilbert, shows it to have a deeper body and shorter fin rays. Jordan and Evermann describe the scales of the blind side as cycloid. In *H. hamiltoni* they are strongly ctenoid, even in the young.

HIPPOGLOSSOIDES DUBIUS (Schmidt).

Cynopsetta dubia SCHMIDT, Faune Mar. Ochotsk, 1903, p. 19.—JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 188.*Hippoglossoides dubius* SCHMIDT, Pisc. Mar. Orient., 1904, p. 227, pl. 6, fig. 1.*Hippoglossoides katakurae* SNYDER, Proc. U. S. Nat. Mus., vol. 40, 1911, p. 546; vol. 42, 1912, p. 438, pl. 58, fig. 1.¹Proc. Biol. Soc. Wash., vol. 11, 1897.

Many specimens were obtained at the following localities:

Albatross stations 4822 and 4828, off west coast of Hondo, Sea of Japan.

Albatross stations 4834, 4835, 4838, 4839, off west coast of Hondo.

Albatross station 4843, near Oki Group, Sea of Japan.

Albatross stations 4855, 4856, 4858, 4859, off east coast of Korea.

Albatross stations 4986, 4989, and 4994, off coast of Hokkaido (Yezo).

Albatross stations 4997, 4998, 5000, 5002, and 5004, Gulf of Tartary.

Albatross stations 5006, 5007, 5008, 5010, Aniwa Bay, Sakhalin Island.

Albatross station 5042, south coast of Hokkaido (Yezo).

Description of a female 332 mm. long to base of caudal, from *Albatross* station 5011.

Head, 0.293 of this length; depth, 0.38; dorsal, 85; anal, 64; pores in the lateral line, 92.

Outline of the head uneven, the dorsal outline sharply angulated at both ends of the mandible; eyes about equal, their anterior borders on about the same vertical; diameter of upper eye 0.05; interorbital moderate and with a fairly straight ridge, extending from the anterior border of the preorbital to the posterior edge of the preopercle; interorbital with about three rows of ctenoid scales; anterior nostril in a tube, the posterior with the margin slightly elevated; length of snout from upper orbit, 0.05; snout with a strong curve above, naked except on anterior margin of orbits; maxillary strongly curved, extending past middle of eye, that of the blind side the longer, its length 0.147, that of the eyed side 0.125; premaxillary unusually broad and produced forward, more so than in any other species of the genus; preorbital broad, covering the maxillary, in some specimens nearly covering premaxillary; teeth uniserial, acute, conic, directed backward, about four premaxillary canines on each side of the jaw, irregularly arranged; behind the canines the teeth are smaller, and are better developed on the blind than on the eyed side; several canines on mandibular symphysis, decreasing in size posteriorly, similarly enlarged on both sides; gill-rakers slender, 3+13 on the eyed side, 3+16 on blind side, the longest 0.03; lower pharyngeals narrow, entirely separated, with one main and one smaller inner row of sharp conical teeth.

Body elliptical, dorsal and ventral outlines similar; depth of caudal peduncle 0.10; length of caudal peduncle (from posterior end of anal), 0.09. Vertebrae 13-29 in one specimen, 13-32 in five specimens, including the hypural plate.

Scales of both sides ctenoid, rougher posteriorly than anteriorly. Lateral line of both sides with a high curve, its length 0.19, its height 0.025.

Dorsal beginning near anterior vertical of orbit, gradually rising for more than half its length; height of longest ray 0.10, the fin rapidly and evenly decreasing in height posterior to the highest ray; anal rising to middle, about equal in height to dorsal; anal spine not strongly projecting; caudal truncate; pectorals rounded, that of the eyed side 0.105, of 10 rays, that of the blind side 0.076, with 10 rays; ventrals symmetrical, each 0.09 and with 6 rays.

Color uniform dark brown, including all fins on eyed side, the ventral somewhat lighter; dorsal and anal with a light margin; fins and body on blind side white.

The curve in the lateral line is variable, with all intermediate forms from a nearly straight line to a high curve with 7 rows of scales between its highest point and the horizontal. The dorsal fin rays in *H. katakurae* are given by Snyder as 80 or 90, the anal rays as 69, agreeing with this species. The vertebrae are 42 to 45 in specimens of this species counted; 41 in the type of *H. katakurae*. *H. katakurae* can not, therefore, be retained as a distinct species.

In the young, especially under 150 mm., the form is much more slender, the depth about 0.33; the dorsal profile is straighter; the mouth is more oblique; the upper orbit is larger; the canines are less developed; the maxillaries are more nearly equal, and the scales are smoother.

The body is apparently always dextral.

These specimens, especially the larger, differ from the original description in having the interorbital scaled, and in usually having weakly ctenoid, rather than cycloid scales on the anterior part of the body, the spines easily breaking off. The blind side usually has ctenoid scales.

This species seems nearest *H. elassodon*, from Alaska and Kamchatka, but differs from that species in the more irregular, highly curved upper jaw; in the greater development of the canines; in having fewer gill-rakers ($x + 16$ to 19 in *H. elassodon*), and usually in the higher curve in the lateral line. Evidently too large a range in fin rays and gill-rakers have been recorded for *H. elassodon*, probably from a confusion with other species. In four specimens of this species in the United States National Museum and in five specimens in the Stanford collection (from Puget Sound and Kamchatka), the gill-rakers are 3 or 4 + 16 to 19.

Table of fin rays and gill-rakers.

Albatross station	4997	5003	4998	4994	4989	5000	4994	5007	4986
Length without caudal, mm	371	332	302	272	308	260	257	425	271
Dorsal rays	82	85	83	82	79	83	82	84	88
Anal rays	64	64	64	64	64	64	67	65	68
Gill-rakers, eyed side	3-12	3-13	3-14	2-11	3-16	3-14	2-15	2-14	3-13
Gill-rakers, blind side	3-14	3-16	3-14	2-12	3-16	3-14	2-13	2-16	3-14

Table of fin rays and gill-rakers—Continued.

Albatross station	5006	5010	5008	5042	4838	5002	4856	4858	4838
Length without caudal, mm	212	217	217	231	173	203	190	188	190
Dorsal rays	85	83	82	81	85	87	82	89	83
Anal rays	65	64	64	63	62	67	63	69	65
Gill-rakers, eyed side	3-13	3-15	3-13	3-12	3-14	3-14	3-15	3-14	3-15
Gill-rakers, blind side	4-15	4-13	3-12	2-13	3-16	3-15	3-15	2-15	3-14

Albatross station	5004	4856	5858	5011	4834	4834	4834	5003
Length without caudal, mm	85	173	159	152	125	118	131	132
Dorsal rays	86	84	80	83	87	85	86	85
Anal rays	65	62	60	65	63	63	69	65
Gill-rakers, eyed side	2-13	3-13	2-13	2-14	2-15	2-14	2-15	3-14
Gill-rakers, blind side	2-12	3-14	3-13	3-14	2-17	3-14	2-14	2-14

Table of measurements in hundredths of length to caudal base.

Albatross station	5003	4998	4994	4994	5000	5007	5042	5010	5006	5002
Pores	92	94	90	89	90	89	89	94	88	86
Length to base caudal, mm	332	302	273	257	260	241	231	217	212	203
Length, head	29.3	31	29	27.5	29	30	29	30	28	27
Depth, body	38	38	41.5	34	39	39	38	39	38	37
Diameter, upper eye	5	5.5	6	6	6	6	6	6	6	6
Snout from upper orbit	5	6	6	5	5	5	5	6	5	5
Maxillary, eyed side	12.5	12	11.5	11	12	11	10	10	11	12
Maxillary, blind side	14.7	15	14	12	13	13	13	13	13	14
Pectoral, eyed side	10.5	12	13	13	13	12	13	13	13	12
Height, dorsal	10.2	11	11	11	11.5	10.5	10	12	11	12
Height, anal	10.3	11	11	10	11	10	11	12	11	10
Length, caudal	18.6	19	21	20	21	19	20	20	19	19
Length, ventral	8.7	9	10	10	10.5	9	10	10	9	9

HIPPOGLOSSOIDES PROPINQUUS, new species.

Plate 26, fig. 5,

As the key indicates, this species is probably most closely related to *H. robustus* and to *H. hamiltoni*, having fewer gill-rakers and fewer fin rays than in *H. elassodon* or *H. dubius*. *H. propinquus* differs from the type of *H. robustus* in the much slenderer body; in having both sides with most of the scales ctenoid, and in the prominent nasal tubes. According to Jordan and Evermann's description of the type of *H. robustus*, it has the depth $2\frac{1}{2}$ in length without caudal (0.47 as measured on the same specimen by Gilbert); "no ctenoid scales on the blind side"; "no exserted nasal tubes." *H. propinquus* differs from *H. hamiltoni* in the shorter pectoral, less than half as long as head, and in the more weakly ctenoid scales. The pectoral of the blind side is covered with ctenoid scales in the adult of *H. hamiltoni*, but always naked in this species. The differences are more apparent in the young. Specimens of the same size when compared with the type of *H. hamiltoni* differ strikingly in the much shorter fin rays, especially the pectoral, and in the more weakly ctenoid scales, those of the blind side nearly smooth instead of strongly ctenoid. The eye is also smaller, 4.25 instead of 3.5 in head.

Type-specimen.—Cat. No. 75667, U.S.N.M. A female 327 mm. long without caudal, 383 mm., with caudal. Albatross station 5005, Aniwa Bay, Sakhalin Island.

Head, 0.29 of total length to caudal base; depth, 0.429; dorsal, 75; anal, 57; pores in the lateral line about 90.

Dorsal outline of head uneven, slightly elevated above the eyes; the anterodorsal margin of the orbit, the upper end of the premaxillary spine, the mandibular angle, and the angular projecting into the profile; eyes about equal, their anterior borders on about the same vertical; diameter of upper eye 0.055; interorbital 0.015, nearly flat, but with the ridge more prominent in some of the paratypes, at the narrowest point with three rows of scales, some of which are ctenoid; interorbital narrower in some paratypes with fewer rougher scales; anterior nostril with a rather short, fleshy tube, the posterior nostril horizontal, with the edges expanded to form a thin-walled tube, shorter than the anterior tube, its dorsal edge the higher; length of snout from anterior margin of upper orbit 0.052, naked except on the anterior borders of the orbits, where the scales are more strongly ctenoid in young paratypes; maxillary strongly curved, but less so than in *H. dubius*, the premaxillary less produced forward; length of maxillary, eyed side 0.113, blind side 0.128; preorbital not covering premaxillary before lower orbit; teeth uniserial, acute, conic, somewhat irregular, enlarged anteriorly in both jaws to form canines, which are less strongly developed than in *H. dubius*; teeth better developed on the blind side; gill-rakers moderately slender; smooth, 1+13 on the eyed side, 2+11 on the blind side, the longest about 0.03, about half the diameter of eye.

Body rather ovate than elliptical; dorsal and anal outlines similar, the ventral a little more strongly curved. Depth of caudal peduncle 0.094, a little more than one-third length of head; length of caudal peduncle about the same. Vertebrae 45 (13+32) in 1 specimen counted, including the hypural plate.

Scales ctenoid, but not very rough, both anteriorly and posteriorly on the eyed side, weakly ctenoid on back and sides of blind side; the belly and the head except the cheeks have ctenoid scales on the eyed side, but cycloid and somewhat imbedded scales on the blind side; fins of eyed side more or less covered with ctenoid scales, naked on the blind side; mandibles, lips, and the maxillaries nearly or entirely naked; smaller paratypes have the blind side nearly smooth, but the interorbital region, margin of orbits, maxillaries, and the sides of the head on the eyed side are rougher.

Dorsal increasing in length for more than half its length, the longest ray about 3.5 in head, the anal similar; anal spine not strongly projecting; pectoral somewhat pointed, a little longer than height of dorsal, of 11 rays; pectoral of blind side shorter and more rounded, with the same number of rays. Ventrals symmetrical in position, each of 6 rays, that of eyed side a little the shorter, but not constantly so.

Color uniform dark brown, slightly mottled in the very young; fins of eyed side dark, the vertical fins tipped with lighter; blind side white including all the fins, the vertical fins darker distally.

The young specimens are very readily separable from the young of *H. dubius*, with which they were taken, not only by the fewer fin rays, but also by the deeper body (ovate instead of elongate-elliptical), by the less oblique mouth, and by the firmer flesh.

Table of fin rays and gill-rakers in all the specimens, including the type and the following paratypes: One from station 5008; four from station 5009; three from station 5011; three from station 5012; one from station 5013; all in Aniwa Bay, Sakhalin Island, dredged at from 40 to 43 fathoms.

<i>Albatross station</i>	5005	5011	5013	5011	5012	5009	5009
Length without caudal, mm	327	306	164	150	143	95	87
Dorsal rays	75	75	72	72	76	71	76
Anal rays	57	57	56	55	57	57	59
Gill-rakers, eyed side	1-13	1-10	2-12	3-10	2-12	3-13	3-13
Gill-rakers, blind side	2-11	3-11	2-12	2-11	2-12	2-12	3-13

<i>Albatross station</i>	5009	5008	5012	5012	5009	5011
Length without caudal, mm	88	82	86	81	77	71
Dorsal rays	72	71	76	75	79	71
Anal rays	55	56	59	58	62	54
Gill-rakers, eyed side	2-10	3-12	2-12	3-11	3-12	2-13
Gill-rakers, blind side	1-11	3-12	2-12	3-11	3-12	3-11

All rudimentary gill-rakers counted.

Measurements in hundredths of length to base of caudal.

<i>Albatross station</i>	5005	5011	5013	5011	5012
Pores	90	93	86	91	89
Length without caudal, mm	327	306	164	150	143
Length, head	29	29.7	27	27.2	27
Depth, body	42.9	42.5	38	39.7	35.2
Depth, caudal peduncle	9.4	9.2	10	9.3	9
Diameter, upper eye	5.5	6	6	5.7	5.6
Interorbital width	1.5	1.3	1.2	1	1
Snout from upper orbit	5.2	5.5	4	4.6	4
Maxillary, eyed side	11.3	11.4	10.8	10.3	10.3
Maxillary, blind side	12.8	12.6	12.2	11.2	11.6
Pectoral, eyed side	12.3	12.1	12	13.4	10.8
Pectoral, blind side	9.6	9.7	9.7	10.4	11.6
Height, dorsal	11.7	11.7	11.5	12.8	11.8
Height, anal	11.7	11.7	12.2	12.8	11.8
Length, caudal	17	19.7	20	20	-----
Length, ventral eyed side	10.5	10.2	8.8	9.7	8.5
Length, ventral blind side	11.1	10	10	10.7	9

Paratypes.—No. 22529 Stanford University Museum.

CLEISTHENES Jordan and Starks.

Cleisthenes JORDAN and STARKS, Bull. U. S. Fish Comm., vol. 22, 1902 (1904), p. 622.

Protopsetta SCHMIDT, Pisc. Mar. Orient., 1904, p. 230.

Cleisthenes includes *Protopsetta*, each having been compared only to *Hippoglossoides*.

Protopsetta was described as allied to *Hippoglossoides*, differing in the insertion of the upper eye, which is placed on the upper outline

of the head, as in *Atheresthes* and *Reinhardtius*. The dorsal begins over the posterior part of the eye, and the teeth are rather small and close together. The paratypes of *Cleisthenes pinetorum* show these same characters, differing from *Hippoglossoides* in the same manner.

Cleisthenes was described as closely allied to *Hippoglossoides*, differing in having cycloid scales everywhere in the young, and an increased number of gill-rakers. The adult has a single series of ctenoid scales along the anterior base of dorsal and anal, a few on the snout, on ridge behind the interorbital space, and on opercle. The dorsal begins on the orbital rim slightly on blind side. Eyes and color on right side. *Protopsetta herzensteini* differs from *Hippoglossoides* in the same manner. The two species are, in fact, very closely related.

CLEISTHENES PINETORUM Jordan and Starks.

Cleisthenes pinetorum JORDAN and STARKS, Bull. U. S. Fish Comm., 22, 1902 (1904), p. 622, with plate. Matsushima Bay.

A single specimen from *Albatross* station 5074, off Matsushima Bay, near the type-locality.

Dorsal, 76; anal, 57; pores, 76; gill-rakers, 8 + 24; length, 171 mm.; head, thirty-hundredths of total length to base of caudal; depth of body, 39; diameter of upper eye, 7; length of snout from upper orbit, 6; length of maxillary of eyed side, 10; of blind side, 10.5; pectoral of eyed side, 15; height of dorsal, 14; height of anal, 13; length of caudal, 23; length of ventral of eyed side, 9.

This species differs from *C. herzensteini* (Schmidt) chiefly in having the scales of the body and head more strongly ctenoid or spinous, and in having a larger number of gill-rakers. The variation of both species as regards the gill-rakers is wide, as the following tables show.

Paratypes of C. pinetorum.

Gill-rakers.....	20	21	22	23	24	25	26	27
Specimens.....	1	3	3	2	4	3	....	1

1 specimen of *C. pinetorum* from *Albatross* station 5047..... 24

C. herzensteini collected by the "Albatross."

Gill-rakers.....	16	17	18	19	20	21	22	23
Specimens.....	1	3	6	8	6	1	....	1

Type of *C. herzensteini*..... 16

2 specimens of *C. herzensteini* from Port Arthur..... 15, 18

Summary.

Gill-rakers.....	15	16	17	18	19	20	21	22	23	24	25	26	27
<i>C. pinetorum</i>						1	3	3	2	4	3	....	1
<i>C. herzensteini</i>	1	2	3	7	8	6	1	....	1	....	....	....	....

CLEISTHENES HERZENSTEINI (Schmidt).

Hippoglossoides herzensteini SCHMIDT, Pisc. Mar. Orient., 1904, p. 229.
Protopsetta herzensteini JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 194.

Albatross stations 4834 and 4838, off west coast of Hondo, Sea of Japan.

Albatross stations 4842, 4843, and 4844, Oki group, Sea of Japan.

Albatross stations 4856, 4859, and 4870, off coast of Korea, Sea of Japan.

Albatross stations 4999, 5000, and 5002, Gulf of Tartary, west of Sakhalin Island.

Albatross station 5010, Aniwa Bay, Sakhalin Island.

Albatross stations 5041 and 5042, off south coast of Hokkaido (Yezo).

Dr. C. H. Gilbert noted the fin rays of five specimens from *Albatross* station 5042, which were not among those preserved.

Dorsal.....	67	71	70	71	70
Anal.....	54	51	56	52	56

Measurements in hundredths of length to base of caudal.

<i>Albatross</i> station.....	4999	5041	5041	4870	4844	4820	4843	4870
Dorsal rays.....	75	72	71	70	70	77	73	71
Anal rays.....	57	53	56	51	54	58	56	54
Pores.....	79	77	77	80	75	84	75	76
Gill-rakers.....	9+21	7+20	8+17	8+18	8+19	8+19	8+19	7+17
Length, mm.....	277	217	193	176	171	172	170	157
Length, head.....	29	28	30	28	30	28	28	30
Depth, body.....	41	38	44	39	39	40	38	41
Diameter, upper eye.....	6.5	6	6	6.5	7	7	7	7
Snout from upper eye.....	6.5	6	6	6	7	6	6.5	6
Maxillary, eyed side.....	9	9	10	10	10	9.5	9	9.5
Maxillary, blind side.....	10	10	10.5	10.5	11	10.5	10	11
Pectoral, eyed side.....	15	15	13	13	13	12.5	14	14
Height, dorsal.....	13	14	13	13	13	12	14	13.5
Height, anal.....	13.5	14	13	13	13	12.5	14	13.5
Length, caudal.....	20	20	21	22	22	21.5	22	22
Length, ventral.....	10	9	9	9	9	9	9	9

ATHERESTHES EVERMANNI Jordan and Starks.

Atheresthes evermanni JORDAN and STARKS, Bull. U. S. Fish Comm., vol. 22, 1902 (1904), p. 630, pl. 5, fig. 1. Matsushima Bay.

Albatross station 5019, east coast of Sakhalin Island, Okhotsk Sea.

Albatross station 5031, Yezo Strait, near Hokkaido (Yezo).

Albatross station 5042, south coast of Hokkaido.

Albatross stations 5047 and 5048, off Matsushima Bay.

Hitherto known only from the type collected by the *Albatross* at Matsushima Bay in 1900.

Young specimens are somewhat spotted.

The specimens collected by the *Albatross* in 1906 differ from the type description in the following characters: Fewer fin rays (dorsal 98 to 111; anal 78 to 89, instead of dorsal 114; anal 94); fewer pores

in all specimens but 1 (89 to 109, instead of 109), this difference being due to the greater development of the pores in the larger specimens, in which small pores are occasionally placed between the larger ones. The teeth are in two rows in both jaws; the outer row of the lower jaw small, even, and close to the main row, so as easily to escape notice. The anterior half of the premaxillaries with a single row of sagittate canines; the posterior half with two rows of much smaller teeth.

Vertebrae $12 + 41 = 53$ in *A. evermanni*; $12 + 37 = 49$ in *A. stomias* of the Alaskan fauna.

Measurements in hundredths of length to base of caudal.

Albatross station.....	5031	5019	5042	5042	5042	5042	5042	5042	5042	5047	5047
Dorsal rays.....	107	101	111	108	104	107	104	111	98	101	105
Anal rays.....	83	80	89	86	83	86	80	89	83	78	84
Pores.....	104	109	94	89	98	99	86	92	92	93	90
Gill-rakers.....	2+10	3+10	2+10	3+10	3+10	2+10	2+10	2+10	3+10	3+10	3+10
Length, mm.....	380	320	176	158	158	158	139	133	133	113	117
Length, head....	28	27	27.5	26	26	26.5	29	27	28	27	29
Depth, body....	37	34	35	34	31	31	38	34	35	36	34
Diameter, upper eye.....	6	6	7	6	6	6.5	8	7	7.5	7.5	8
Snout from upper eye.....	6.5	6	6	6	6	6	7	6.5	6.5	6	7
Maxillary, eyed side.....	16	16	15	14	14	14	15	14.5	15	14	16
Maxillary, blind side.....	17	17	16	14.5	14.5	15	17	16	16.5	16	17
Pectoral, eyed side.....	13	13	12	11	11	11	12	12	12	12	15
Pectoral, blind side.....	9	9	8.5	.....	7.5	8	8.5	9	9	.....	9
Height, dorsal..	11	12	13	12	.....	12	12	12	12	12	13
Height, anal....	11	12	12.5	.....	.....	12	11	11	12	11	12
Length, caudal..	15	15	17	16	.....	15	17	17	17	17	18
Length, ventral, eyed side.....	7	7	6.5	.....	6	6	6	7	7	7	8.5

Subfamily PLEURONECTINAE.

Genus POECILOPSETTA Günther.

Poecilopsetta GÜNTHER, Shore Fishes, *Challenger*, p. 48.

POECILOPSETTA PLINTHUS (Jordan and Starks).

Alaeops plinthus JORDAN and STARKS, Bull. U. S. Fish Comm., vol. 22, 1902 (1904), p. 623, pl. 5, fig. 2. Suruga Bay; Owari Bay.

Albatross station 4946, near Kagoshima, Kiusiu.

Albatross stations 5071 and 5074, Suruga Gulf.

The scales in this species are ctenoid with blunt, rounded spines, as in *Poecilopsetta hawaiiensis* Gilbert.

Lateral line absent on blind side in both species.

The scales in *P. hawaiiensis* are smaller; the pores in the lateral line 84 to 97. As this is the only important difference between the two species, their relationship would probably be better expressed by placing them in the same genus.

Measurements in hundredths of length to base of caudal.

<i>Albatross station</i>	5071	5071	5071	5074	5074	5074	4946
Dorsal rays.....	60	61	61	61	62	-----	59
Anal rays.....	52	49	51	45	52	52	49
Pores.....	60	61	62	66	67	-----	64
Gill-rakers.....	6+10	6+10	5+9	5+9	x+10	x+10	5+9
Length, mm.....	94	87	77	75	69	67	71
Length, head.....	22	24	24	23	24	24	23
Depth, body.....	44	46	43	42	41	42	38
Diameter, upper eye.....	7	7	7	7	7	8	7
Snout from upper eye.....	5.5	5	6	5	-----	-----	-----
Maxillary, eyed side.....	7	7	7	7	7	8	7
Pectoral, eyed side.....	12	12	12	11.5	12	13	12
Ventral, eyed side.....	9	9	10	10	11	11	10
Length, caudal.....	27	28	27	28	28	29	28
Height, dorsal.....	11	12	11	11	11	12	12
Height, anal.....	11	11	11	11	11	12	12

PLEURONICHTHYS CORNUTUS (Temminck and Schlegel).

Platessa cornuta TEMMINCK and SCHLEGEL, Fauna Japonica, Poiss., 1846, p. 179, pl. 90, fig. 1. Nagasaki.

Pleuronichthys cornutus JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 201.

Albatross stations 4878 and 4885, Eastern Sea.

Albatross station 4946, near Kagoshima, south coast of Kiusiu.

One specimen from Tsuruga, collected by the *Albatross* on July 24, 1906.

In 30 specimens, including several in the collections of Stanford University, 15 have 5 gill-rakers on the lower limb of the arch, 13 have 6, and 1 has 7, another has 2+7 on the blind side, 2+9 on the eyed side; the rudimentary gill-rakers are counted.

One specimen, 112 mm. long, from Swatow, China, reported on by Rutter,¹ collected by Miss A. M. Fielde, and in the collections of Stanford University, shows several points of difference when compared with Japanese specimens. The gill-rakers are more numerous, longer, and slenderer, 3 on the upper limb on both sides, 8 on the lower limb of the blind side, 7 on the lower limb of the eyed side, the total number 10 or 11 instead of 7 or 8 as usual in Japanese specimens. The spines of the head are developed more strongly. The height of the spine at the posterior end of the interorbital, measured from the lower surface of the interorbital bone, is 2 in upper eye (3.5 or rarely 2.7 in Japanese specimens). The spine at the anterior end of the interorbital is of the same length as the posterior spine when measured from the upper ridge of the interorbital. Four dorsal rays are extended on the blind side of the head, reaching to opposite the upper margin of the premaxillary. In Japanese specimens only 3 rays are on the blind side of the head, and they do not extend to the upper margin of the premaxillary.

The specimen collected by A. M. Fielde at Swatow, China, may finally prove distinct from *P. cornutus*, but the material at hand does not justify its description at present as a new species.

¹ Proc. Acad. Nat. Sci., Phila., 1897, p. 88.

The anal spine is very slightly developed in the young, absent in the adult.

Three of the specimens collected by Jordan and Snyder at Aomori, Japan, show a remarkable variation of the anterior rays of the dorsal fin; they are not deflected onto the blind side as normally in *Pleuronichthys*, but are borne on a thick hook, which is extended nearly straight forward. This variation may have been produced during the translation of the eye. These specimens, and to a lesser degree other specimens from the same locality, show a more or less complete coloration of the blind side.

Measurements in hundredths of length to base of caudal. The first specimen is from Swatow, China.

<i>Albatross</i> station		4878	4885	4946	4946	4946	4946
Dorsal rays.....	76	70	71	74	76	70	70
Anal rays.....	55	51	51	51	51	50	50
Pectoral rays.....	9	10	9	9	8	8	9
Gill-rakers.....	3+8	3+5	3+5	3+5	3+6	3+5	x+5
Length, mm.....	112	138	97	93	92	91	82
Length, head.....	24	21	24	24	24	24	24
Depth, body.....	51	49	51	49	51	50	50
Diameter, upper eye.....	8	6.5	7	7	8	8	7.5
Snout from upper eye.....	4	4	4	4	4	4	4
Maxillary, eyed side.....	5.5	6	7	6	6	6	6
Pectoral, eyed side.....	14	13	12	11	13	13	13
Ventral, eyed side.....	10.5	9	10	10	10	10	10
Length, caudal.....	28	29	28	28	29	30	32
Height, dorsal.....	17	14	17	17	17	18	18
Height, anal.....	17	13	17	17	17	18	18

LEPIDOPSETTA BILINEATA (Ayres).

Platessa bilineata AYRES, Proc. Cal. Acad. Sci., 1855, p. 40. San Francisco, California.

Lepidopsetta bilineata GILL, Proc. Acad. Nat. Sci., Phila., p. 195.—JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 203.

Two young specimens from Petropavlovsk, Kamchatka, collected by the *Albatross*, June 18, 1906:

Length.	Dorsal rays.	Anal rays.	Pores.	Gill-rakers.
<i>mm.</i> 104 88	79 82	59 61	90 90	3+8 4+7

LEPIDOPSETTA MOCHIGAREI Snyder.

Lepidopsetta mochigarei SNYDER, Proc. U. S. Nat. Mus., vol. 40, 1911, p. 547; vol. 42, 1912, p. 440, pl. 58, fig. 2.

Albatross station 4808, Tsugaru Strait.

Albatross station 4993, Sea of Japan, northwest of Hokkaido (Yezo).

Albatross stations 4999, 5003, and 5004, Gulf of Tartary.

Albatross stations 5006, 5007, 5008, and 5010, Aniwa Bay, Sakhalin Island.

Albatross station 5031, Yezo Strait.

Albatross station 5067, Suruga Gulf, Hondo.

This species seems to represent *L. bilineata* in northern Japan, and differs from that species as follows:

- 1. Higher, sharper interorbital.
 - 2. Usually larger eyes.
 - 3. Upper profile of head straighter.
 - 4. Smaller scales, pores 95 to 99 rather than 79 to 95.
 - 5. Anterior nasal flap shorter, reaching only one-half the distance to posterior nostrils, nearly reaching posterior nostril in *L. bilineata*.
 - 6. The mucous pores of the head are much more pronounced.
 - 7. One or two instead of three or four series of scales on anterior border of orbits.
 - 8. The scales are smoother, and of a different character, the roughest with 2 rows of spines, 2 in the apical row, and 5 or 6 in a row parallel with this; *L. bilineata* has a similar apical row, and about 10 to 15 in the other row;
 - 9. Head more acute;
 - 10. Fewer gill-rakers, 3 or 4 + 7 to 9 in *L. bilineata*.
- Gill-rakers in *L. mochigarei*:

Specimens.	On eyed side.	On blind side.
5	2+5	2+5
2	2+6	2+6
3	2+5	2+6
3	2+6	2+5
1	2+6	1+7
1	2+6	1+8

A minute rudimentary gill-raker is sometimes present on the upper limb of the first arch, but is not included in the table.

The fin formula agrees with that of *L. bilineata*.

Measurements in hundredths of length to base of caudal.

<i>Albatross</i> station.....	4993	4999	4993	4808
Dorsal rays.....	75	77	74	72
Anal rays.....	59	60	59	57
Pores.....	96	95	98	97
Pectoral rays.....	10	10	10	10
Length to base caudal, mm.....	262	242	183	148
Length of accessory branch in the lateral line.....	6.5	4.5	4.5	5
Length, head.....	27	26	29	29
Depth, body.....	48	48	47	47
Diameter, upper eye.....	6	6	7	7
Snout from upper orbit.....	6	6	6	6
Maxillary, eyed side.....	6.5	7	8	8
Pectoral, eyed side.....	12	13	14	15
Pectoral, blind side.....	8	10	10	10
Ventral, eyed side.....	9	10	10	10
Height, dorsal.....	11	12	12	14
Height, anal.....	11	12	12	12

Genus LIMANDA Gottsche.

The fauna of northern Japan (including Sakhalin Island) is rich in species of this genus, 9 being known, 3 of these, from Sakhalin Island, being here described as new.

Key to the species of Limanda found in Japan and Sakhalin Island.

- a*¹. Teeth conical, in an irregular series more or less extended on eyed side of jaws.
 - b*¹. *Limanda*.—Snout not produced; no yellow streaks on blind side.
 - c*¹. Interorbital moderate, horizontal, scaly.
 - d*¹. Scales ctenoid, each with about 10 spines; lower jaw not projecting; ridges of head not prominent.
 - e*¹. Depth, 0.44 to 0.55; teeth in an even row; upper jaw of eyed side arched.....*aspera*.
 - e*². Depth, 0.39 to 0.46; teeth more separated and uneven; upper jaw of eyed side nearly straight.....*sakhalinensis*.
 - d*². Scales ctenoid, each with a single spine; lower jaw projecting; ridges of head prominent.....*asprella*.
 - c*². Interorbital narrow, sharp and naked; depth, 0.415 to 0.47.....*korigarei*.
 - b*². *Myzopsetta* Gill.—Snout produced; yellow streaks along bases of vertical fins on blind side.
 - g*¹. Scales about 70, cycloid on blind side.....*iridorum*.
 - g*². Scales about 90, ctenoid on blind side.....*proboscidea*.
- a*². *Limandella*.—Teeth broad, truncate, close-set, confined chiefly to the blind side of each jaw; mouth very unsymmetrical.
 - h*¹. Dorsal rays, 61 to 63; eye, 5.7 to 6.9 in head.....*schrenki*.
 - h*². Dorsal rays, 65 to 75; eye, 4 to 5.5 in head.
 - i*¹. Snout slender; interorbital narrow, naked in front.....*angustirostris*.
 - i*². Snout blunt; interorbital wide, entirely scaled.....*yokohamae*.

LIMANDA ASPERA (Pallas).

Pleuronectes asper PALLAS, Zoogr. Rosso-Asiat., vol. 3, 1811, p. 425.

Limanda aspera JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 204.

Numerous specimens from Petropavlovsk, Kamchatka, collected on June 18–19, 1906, by the Fisheries steamer *Albatross*.

Description of a male, 132 mm. long, from Petropavlovsk, Kamchatka.

Length of head, 0.245 of total length without caudal; depth, 0.45; dorsal, 77; anal, 57; pores in the lateral line, 83.

Head thick and rounded; elevation above the eye slight; ventral outline nearly straight, the posterior end of mandible not prominent; greatest width of head, 0.09; eyes small, nearly round, equal, and on nearly the same vertical, the upper inserted high, its longitudinal diameter, 0.05; eyes separated by a moderate, flat interorbital, its entire width, 0.02; head without spines or tubercles, the ridge posterior to eyes little developed, its surface slightly rough; nostrils of the blind side nearly on ridge of snout, those of eyed side in the same horizontal line in front of interorbital; edges of all nostrils entire; both nostrils tubular, the posterior tube small with puckered

edges; snout obtuse, gently curved, its length from upper orbit, 0.04; dorsal outline of snout at right angles to upper margin of premaxillary; maxillary of eyed side reaching vertical of anterior margin of pupil; upper jaw strongly arched upward and outward anterior to the lower eye; posterior edge of maxillary broad, its greatest width, 0.025; length of maxillary of eyed side, 0.065, of blind side, 0.07; teeth blunt, in a somewhat irregular row, often truncate, some even indented; gill-rakers short and stout, 7+10, the longest, 0.013.

Body oval, rather robust, its width 0.20 of its depth; depth of caudal peduncle, 0.11; tip of mandible to anus, 0.29 (varying to 0.33); the anus partly on blind side.

Scales spinous on eyed side, cycloid on blind side (scales rough on both sides in larger specimens). Lateral line with a moderate arch in front, 6 rows of scales between its highest part and the horizontal portion, height of curve 11 in straight part, its length 3.5 in straight part (varying to 3 in larger specimens); one branch of lateral line extends sharply upward from the nape, for most of its length parallel to the bony ridge; the suborbital branch extends as a semi-circular arch to tip of maxillary, clearing the lower margin of orbit by 0.012, with 18 (to 20) pores; interorbital with 1 or 2 uneven rows of cycloid scales (often with 3 rows of ctenoid scales in larger specimens); tips of snout, lips of both sides, and the exposed portion of the opercular bones and the ridge anterior to nape on the blind side naked. Fins on eyed side with a few small scales on rays. Dorsal beginning on median line over anterior border of pupil, rising to the fortieth ray, its greatest height 0.13, distance from tip of snout to base of highest dorsal ray, 0.58; fleshy tips of rays free; anal similar, its highest ray about middle of fin; anal spine present; caudal slightly rounded, 0.20; pectorals broad and rounded, each of 11 rays, length, eyed side, 0.16, blind side, 0.11; ventral of blind side slightly anterior, length of each, 0.10, extended to second anal ray; each ventral of 6 rays.

Color brown, with irregular spots of constant position, 1 spot on lateral line at about the middle of its straight part, 5 to 8 above the lateral line below the dorsal base a distance about equal to the diameter of the eye; similar spots near anal fin, and others in various positions; about 8 vertically elongate spots on dorsal, about 7 on anal, in addition to which all the fins of the eyed side are finely spotted. The spots are less evident in larger specimens. "The lower side of the vertical fins is always yellow."¹

An adult female, 289 mm. long without caudal, from Aniwa Bay, Sakhalin Island, is identical with specimens from Alaska. Dorsal, 70; anal, 54; pores, 80; gill-rakers, 6-8; length of head, 0.25;

¹ Note taken by Dr. C. H. Gilbert from these specimens.

greatest width of head, 0.087; diameter of upper eye, 0.04; inter-orbital width about 0.02, wide and flat, with a median row of spinous scales, anterior border of orbits and snout above nostrils with non-imbricate, spinous scales; length of snout from upper orbit, 0.04; length of maxillary, eyed side, 0.07, blind side, 0.077; scales rough on both sides; suborbital branch of lateral line with 18 pores; length of pectoral, eyed side, 0.165, blind side, 0.125; length of ventrals, 0.105; length of caudal, 0.204; height of dorsal, 0.145, of anal, 0.14. Color dark brown, with large blackish markings.

Table of measurements in hundredths of length to caudal base.

Dorsal rays.....	77	69	70	68	72	68	69	67	70	70
Anal rays.....	57	53	55	53	58	54	53	53	54	55
Pores.....	83	83	80	84	85	85	84	87	90	83
Gill-rakers.....	7+10	5+8	5+8	5+8	6+8	6+9	5+9	5+9	6+9	6+8
Length, mm.....	132	114	111	113	109	112	108	107	103	95
Length, head.....	24.5	25	25	25	25	25	25	26	25	25.5
Depth, body.....	45	48	49	47	48	44	46	48	47	47
Diameter, upper eye.....	5	6	5	5	5	5.5	5.5	6	6	6
Snout from upper eye.....	4	5	4	4	4	4	4	4.5	4	4.5
Maxillary, eyed side.....	6.5	7	7	7	7	7	6.5	7	7	7
Pectoral, eyed side.....	16	15	14	15	17	14	15	16	13	15
Ventral, eyed side.....	10	10	11	11	11	10	10	10	10	11
Length, caudal.....	20	21	22	22	23	20	23	23	22	22
Height, dorsal.....	13	14	15	14	13	15	15	15	13	15
Height, anal.....	13	14	13	13	13	13	14	15	13	15

LIMANDA SAKHALINENSIS, new species.

Plate 26, fig. 6.

This species is closely related to *L. aspera*, but differs in the following points:

1. Plain coloration.
2. Sharper, more compressed head.
3. The suborbital branch of lateral line on head with fewer pores, opening in much more pronounced tubes, the number 11 to 13 (18 to 20 in *L. aspera*).

4. Form more slender, depth 0.39 to 0.46 of total length without caudal (44 to 55 in *L. aspera*).

5. Teeth more conical, more separated, and more uneven in size.

6. Upper jaw of eyed side much less arched.

Type-specimen.—Cat. No. 75674, U.S.N.M., a male 155 mm. long, from Albatross station 5013, in Aniwa Bay, Sakhalin Island; depth, 43 fathoms.

Length of head, 0.25 of total length without caudal; depth, 0.425; dorsal, 74; anal, 58; pores in lateral line, 91.

Head sharp, slender, and compressed (more so than in *L. aspera*), the dorsal and ventral outlines similar; greatest width of head, 0.07; eyes similar to those of *L. aspera*, diameter of upper, 0.055; inter-orbital narrow and with a more pronounced ridge than in *L. aspera*, its total width 0.015; head without spines or pronounced ridges, the ridge posterior to eyes nearly obsolete, even less evident than in *L. aspera*; nostrils in short tubes, edges of posterior nostril of

blind side wavy; snout slightly curved, its upper margin indented at posterior end of premaxillary spine, its length from upper orbit 0.05, its outline not quite perpendicular to upper margin of premaxillary; maxillary not reaching vertical of anterior margin of pupil by about two-thirds diameter of pupil; jaws of each side nearly straight, the mouth being nearly symmetrical; maxillaries not so wide posteriorly as in *L. aspera*, their greatest width 0.02; length of maxillary of eyed side 0.075, of blind side 0.08; teeth conical on both sides of jaws, a few along sides of both jaws somewhat enlarged, making the series more irregular than in *L. aspera*; gill-rakers longer than in *L. aspera*, more constant in size, the anterior 4 or 5 on the lower limb not being greatly reduced, the number 5 + 10; length of longest gill-raker 0.016.

Body oval, rather angular at both extremes, its greatest width 0.18 of its depth; depth of caudal peduncle, 0.11; tip of mandible to anus, 0.33; anus partly on blind side.

Scales on eyed side provided with a single row of sharp but rather weak spines, 0 to 10 in number. Lateral line with an arch, about 7 rows of scales between its highest point and the horizontal part; height of arch 12 in straight part, length 3.8; the suborbital branch of lateral line less semicircular than in *L. aspera*, with 13 pores, clearing the margin of the lower orbit below pupil by 0.01; pores in lateral line, both on head and body, in much more pronounced tubes than in *L. aspera*; interorbital with 3 rows of spinous scales, widening posteriorly to 4 rows; snout, except for anterior margin of orbits, lips on both sides, and on the blind side the exposed portion of the opercular bones and the ridge anterior to nape, naked; fins of eyed side with a few small scales on rays.

Fins as in *L. aspera*, except that the ventral is shorter, extending only to anal spine. Height of dorsal, 0.145; of anal, 0.13; length of caudal, 0.21; of pectoral, eyed side, 0.14; blind side, 0.10; ventrals almost perfectly symmetrical, each 0.09.

Color uniform brown, without spots on fins or body.

Paratype.—No. 22530, Stanford University Museum. A male 128 mm. long, from *Albatross* station 5025, in 52 fathoms off the east coast of Sakhalin Island.

Length of head, 0.24 of total length without caudal; depth, 0.39; dorsal, 69; anal, 54; pores in the lateral line, 83; greatest width of head, 0.07; diameter of upper eye, 0.06; entire width of interorbital, 0.015; posterior nostril of the blind side with indented edges; length of snout from upper orbit, 0.04; maxillary of eyed side, 0.07, its greatest width, 0.02; gill-rakers 5 + 9, length of longest, 0.016; greatest width of body 0.20 of its depth; tip of mandible to anus, 0.30; length of arch in lateral line 3.5 in straight part, its height 14 in straight part; interorbital with a single series of ctenoid scales,

widening to 2 rows posteriorly; 11 pores in suborbital branch of lateral line; height of dorsal, 0.13; of anal, 0.13; length of caudal, 0.21; of pectoral on eyed side, 0.15; of pectoral on blind side, 0.11; of ventral on eyed side, 0.095, both ventrals similar and symmetrical; color uniform brown, unspotted on body and fins.

Another specimen, a male, 171 mm. long to base of caudal, was taken at *Albatross* station 5008, Aniwa Bay, Sakhalin Island, 40 fathoms.

Depth, 0.46; dorsal, 71; anal, 55; pores, 84; greatest width of head, 0.07; diameter of upper eye, 0.05; entire interorbital width, 0.015; maxillary of eyed side, 0.07; gill-rakers, 7 + 9; greatest width of body, 0.15 of its depth; tip of mandible to anus, 0.325; length of arch in lateral line 3.5 in straight part; its height 11.2 in straight part; interorbital at its narrowest point with 2 rows of ctenoid scales; 11 pores in suborbital branch of lateral line; height of dorsal, 0.125; of anal, 0.135; length of caudal, 0.21; of pectoral, eyed side, 0.12; blind side, 0.10; of ventrals, 0.095. Scales of blind side weakly ctenoid.

LIMANDA ASPRELLA, new species.

Plate 27, fig. 7.

Type-specimen.—Cat. No. 75668, U.S.N.M. A male 185 mm. long, from the fish market of Korsakov, Aniwa Bay, Sakhalin Island, collected by the *Albatross* on September 25, 1913.

This species differs from *Limanda aspera* and *L. sakhalinensis* in the much smoother scales, only a few scattered ones with a single median spine, while in the related species spines are present on most of the scales and may be as numerous as 10. It also differs in the more pronounced ridges of the head and in the projecting lower jaw. It resembles *L. aspera* and differs from *L. sakhalinensis* in the arched upper jaw of the eyed side; in having 18 pores in the suborbital branch of the lateral line; in the less compressed head; and in the deeper body.

Length of head, 0.27 of total length without caudal; depth, 0.53; dorsal, 69; anal, 55; pores in the lateral line, 82.

Head comparatively long, rather wide, its greatest width 0.09; dorsal outline gently raised above eye; ventral outline nearly straight, the posterior end of mandible not prominent; eyes equal in size and on the same vertical; diameter of upper eye, 0.05; eyes separated by a wide, raised interorbital; its entire width, 0.02; ridge not sharp, but extended forward to form a high and prominent ridge on the anterior margin of the lower eye; ridge behind upper eye sharp and prominent; nuchal tubercle strong; ridge of preopercle strong and angular; nostrils of eyed side as in *L. aspera*; the edges of the posterior nostril of the blind side sharply indented; region of snout subquadrate in outline, its length from upper orbit, 0.05; upper jaw of eyed side strongly curved anteriorly, the lower jaw projecting; the teeth of the lower jaw visible, without the snout, when the mouth is

closed; maxillary of eyed side extending to below anterior margin of pupil; its greatest width, 0.02; its length, 0.075; length of maxillary of blind side, 0.085; teeth bluntly conic, in a rather uneven series on both sides of jaws, those on the eyed side of upper jaw strong but short; gill-rakers, 6+9, those on the upper limb and the anterior 4 of the lower limb considerably reduced in size, as in *L. aspera*.

Body ovate, rather angular at anterior end, more compressed than usual, greatest width 0.16 of greatest depth; depth of caudal peduncle, 0.115; tip of mandible to anus, 0.25; anus partly on blind side.

Only a few scattered scales ctenoid, those with only a single median spine, the ctenoid scales mostly on eyed side; a few scales in a rough area in front of ventrals, on each side, with 2 spines; scales on upper pectoral ray with 1 spine; interorbital and anterior margins of orbits with a single row of cycloid scales; head with naked areas as in preceding species; arch of lateral line long and regularly semioval in form, its length 3 in straight part, its height 10.

Fins as in related forms, except that the highest dorsal rays are nearer the middle of the body; pectoral long; anal spine present; ventrals symmetrical, their tips reaching origin of anal. Height of dorsal, 0.15; of anal, 0.15; length of caudal, 0.20; of pectoral, eyed side, 0.18, blind side, 0.12; of ventrals, 0.105, both ventrals alike.

Color uniform dark brown on body and fins.

Only the type known.

LIMANDA KORIGAREI, new species.

Plate 27, fig. 8.

This species is related to others of the *L. aspera* group, but differs from them in the high, naked interorbital and anterior margins of orbits, the ridge oblique, the anterior end the higher; and in the longer, more elliptical arch in the lateral line. The suborbital branch of the lateral line has 14 or 15 pores, 11 to 13 in *L. sakhalinensis*, 18 to 20 in *L. aspera*.

Type-specimen.—Cat. No. 75669, U.S.N.M. A male 234 mm. long to base of caudal, from *Albatross* station 5008, Aniwa Bay, Sakhalin Island, depth 40 fathoms.

Length of head, 0.25 of total length without caudal; depth, 0.47; dorsal 73; anal, 59; pores in the lateral line, 90.

Head sharp and compressed, as in *L. sakhalinensis*; orbits somewhat elliptical, the upper slightly posterior; diameter of upper eye, 0.055; eyes separated by a high, narrow, naked interorbital, the entire width of which is 0.010; the ridge sharp, extending from a prominent anterior margin of lower orbit to posterior margin of upper orbit; edges of posterior nostril little expanded; snout indented above, its length from upper orbit 0.05; jaws straight, the

mouth nearly symmetrical, the maxillary of eyed side not reaching to below pupil, its greatest width 0.02, its length 0.07; length of maxillary of blind side, 0.075; teeth bluntly conic on sides of jaws, in a subequal series; gill-rakers, 7 + 10.

Body nearly oval, the ventral surface slightly more curved than the dorsal, strongly compressed, the width only 0.16 of depth; tip of mandible to anus, 0.315; anus nearly on midline.

Scales of both sides ctenoid, not very rough, as in *L. sakhalinensis*; but with finer and more numerous spines than in *L. aspera*; inter-orbital, anterior margin of orbits, snout, and jaws naked, excepting a few scales near tip of maxillary; suborbital branch of lateral line with 15 pores. Arch in lateral line long and low, regularly semi-elliptical in form, its length 3.2 in straight part, its height 12.

Fins short; ventrals symmetrical, reaching anal spine; height of dorsal, 0.125; of anal, 0.12; length of pectoral, eyed side, 0.136; blind side, 0.116; ventrals, 0.085.

Color uniform brown on body and fins.

Kori-garei is the Japanese name for *L. schrenki*.

Paratype.—No. 22532, Stanford University Museum, from Albatross station 5007, depth 42 fathoms.

Other specimens from station 5012, 42–43 fathoms; 5011, 42 fathoms; all in Aniwa Bay, Sakhalin Island.

<i>Albatross station</i>	5007	5011	5012
Dorsal rays	77	72	73
Anal rays	63	55	55
Pores	85	84	86
Gill-rakers	6+10	6+10	6+10
Length to base of caudal, mm.	180	172	193
Length, head	23	23.7	23
Depth, body	42	44.7	41.5
Diameter, upper eye	6	6	5
Snout from upper orbit	4	4	4.5
Maxillary, eyed side	7	7	6.5
Pectoral, eyed side	12	13	11.5
Ventral, eyed side	8.5	9	8
Height, dorsal	12	11.7	11.7
Height, anal	12	11.7	11.7

LIMANDA IRIDORUM Jordan and Starks.

Limanda iridorum JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 206, fig. 14. Mororan.

Two large specimens from Korsakov, Aniwa Bay, Sakhalin Island, collected by the *Albatross*, September 25, 1906.

Three small specimens, collected at Mororan, Japan, July 6, 1906, by the *Albatross*.

Length.	Dorsal rays.	Anal rays.	Pores.	Gill-rakers.
<i>mm.</i>				
287	59	46	73	5+11
277	61	45	73	5+11
96	65	47	77	5+12
93	58	42	69	5+11

The specimens from Korsakov have a broad band of yellow below dorsal base and above anal base, on the blind side.

LIMANDA ANGUSTIROSTRIS Kitahara.

Limanda angustirostris KITAHARA, in Jordan and Starks, Proc. U. S. Nat. Mus., 1906, p. 208, fig. 15. Aomori.

Albatross stations 4815, 4816, 4817, near Sado Island, Sea of Japan.

Albatross station 4832, off Tsuruga, Sea of Japan.

Albatross station 4842, Dogo Island, Oki Group, Sea of Japan.

These specimens differ from the types from Aomori, Hokkaido, in the smoother scales and in the more pronounced spots. The type description gives the color as “uniform slaty brown, without definite markings. The unpaired fins lighter; no color on the blind side.” Traces of definite spots can be found on the paratypes, corresponding to those on the specimens from the Sea of Japan. The color may be described as follows:

Dorsal and anal fins with about 8 bars covering about one-third the length of a ray; below base of dorsal a series of 4 to 7 large dark-brown spots, edged with gray on their lower margins; 4 large dark spots on lateral line, 1 at its origin, 1 at posterior end of arch, 1 at base of caudal peduncle, and 1 between the last 2; these are sometimes bordered with gray, the anterior 2 on their posterior borders, the posterior 2 on their anterior borders; 1 or 2 small spots may be present above the ventrals, and 4 or 5, bordered above with gray, above the anal base; caudal with a spot on each side of the lateral line.

Measurements in hundredths of length to base of caudal.

<i>Albatross</i> station.....	4816	4842	4815	4815	4816	4816	4832	Aomori.		
Dorsal rays.....	72	67	67	68	70	73	69	71	71	71
Anal rays.....	57	51	55	54	55	57	53	57	51	54
Pores.....	74	74	74	76	77	75	73	78	74	76
Gill-rakers.....	2+6	3+6	3+6	3+6	13+8	3+6	13+8	2+6	2+6	13+8
Length, mm.....	202	152	147	144	133	127	115	235	163	153
Length, head.....	24	28	27	25	26	26	26	26	27	27
Depth, body.....	42	43	38	38	40	38	41	44	43	39
Arch of lateral line in straight part.....	3.4	3.3	3.7	3.4	3.4	3.5	3.6	3.7	3.6	3.7
Diameter, upper eye.....	6	7	7	6	6.5	6	7	5	6	6
Snout from upper eye.....	4	4	5	4	4.5	4	4	5	4.5	4
Maxillary, eyed side.....	6	.....	6	6	6	6	6	6.5	6	6
Pectoral, eyed side.....	14	16	15	11	13	14	15	16	17	16
Ventral, eyed side.....	9	10	9	8	9	9.5	10	9.5	10	.....
Length, caudal.....	20	22	22	21	22	23	23	19	21	21.5
Height, dorsal.....	13	14	14	13	14	15	15	14	16	15
Height, anal.....	12.5	14	13.5	13	14	14	14	12	15	15

¹ Last 2 rudimentary.

The last 3 specimens of the table, from Aomori, are paratypes.

LIMANDA YOKOHAMAE (Günther).

Pleuronectes yokohamae GÜNTHER, Shore Fishes, *Challenger*, 1880, p. 69. Inland Sea; Yokohama.

Limanda yokohamae JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 209.

One specimen from Saigo, Dogo Island, Oki Group, in the Sea of Japan, collected by the *Albatross*.

Dorsal, 65; anal, 53; pores, 80. Another specimen from Ebisu, Dogo Island.

This species is possibly the same as *L. schrenki* Schmidt (misspelled *L. schrencki* by Jordan and Starks). *L. herzensteini* Jordan and Snyder, is a very doubtful synonym.

Genus LIOPSETTA Gill.

Liopsetta GILL, Proc. Acad. Nat. Sci. Phila., 1864, p. 217 (*glaber*=*putnami*).

Euchalarodus GILL, Proc. Acad. Nat. Sci. Phila., 1864, p. 222 (*putnami*).

This genus differs from *Limanda* in the broad appressed pharyngeals, with blunt teeth, and in lacking the semicircular arch in the lateral line, although a high curve may be present. *Liopsetta* is also very close to *Pleuronectes*, but that genus has a single row of teeth on each side of the lower pharyngeals. The males of all known species have much rougher scales than the females. Difference in the character of the lower pharyngeals and of the arch in the lateral line seems to separate two natural groups, which are here described as subgenera.

GAREUS, new subgenus.

This subgenus includes only *Liopsetta obscura* (Herzenstein) and is characterized by the high curve in the lateral line, its height about five in straight part, and by the broad lower pharyngeals, closely appressed for half of their length, each side with two rows of large blunt teeth.

Type of the subgenus.—*Pleuronectes obscurus* Herzenstein.¹

“Garei” is the Japanese word for flounder.

LIOPSETTA Gill.

This group includes *Liopsetta glacialis*, *L. putnami*, and *L. pinnifasciata*. It may be characterized by the straight lateral line, and by the massive lower pharyngeals, closely appressed for more than half their length, and nearly triangular in form, the blunt teeth of which are arranged on each side to form an inner, an outer, and an upper row, with one or more series between these.

LIOPSETTA OBSCURA (Herzenstein).

Pleuronectes obscurus HERZENSTEIN, Mélanges Biologiques, 1890, p. 127. Chemulpo; Vladivostok.

Liopsetta obscura JORDAN and GILBERT, Rep. Fur Seal Invest., vol. 3, 1898, p. 492.—JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 217.

This species is superficially very similar to *Limanda yokohamae*, the low arch of that species closely approaching the high curve of *Liopsetta obscura*. The long, slender pharyngeals in the former species (as usual in *Limanda*) not being appressed, and with two rows of conic teeth, easily separate it from *Liopsetta obscura*.

¹ Mélanges Biologiques, 1890, p. 127.

Two specimens from the market at Korsakov, Aniwa Bay, Saghalin Island.

Dorsal, 60; anal, 44; pores, 79; gill-rakers, 4-7, 4-7; length, 200 mm.

Dorsal, 60; anal, 43; pores, 77; gill-rakers, 3-8, 4-7; length, 222 mm.

LIOPSETTA GLACIALIS Pallas.

Liopsetta glacialis PALLAS, Itin., vol. 3, App., p. 706.

Nine specimens from Petropavlovsk, Kamchatka, collected by the *Albatross*, June 18-19, 1906.

LIOPSETTA PINNIFASCIATA (Kner).

Pleuronectes pinnifasciatus KNER, in Steindachner, Über einige Pleuronectiden, etc., aus Decastris Bay, 1870, p. 422, pl. 1, fig. 1.

Liopsetta pinnifasciata JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 217.

Two females, with cycloid, embedded scales, from the market at Korsakov, Aniwa Bay, Sakhalin Island.

Length.	Dorsal rays.	Anal rays.	Pores.	Gill-rakers.
<i>mm.</i>				
285	59	42	73	4+8
275	57	41	76	4+10

L. pinnifasciata is typical of the subgenus *Liopsetta*; it represents *L. glacialis* in the northern Japanese fauna, and is closely allied to it, differing in the deeper body, more pronounced bars on the fins, and the longer snout.

DEXISTES RIKUZENIUS Jordan and Starks.

Dexistes rikuzenius Jordan and Starks, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 212; Bull. U. S. Fish Comm., vol. 22, 1902 (1904), p. 624, pl. 6, fig. 1.

Albatross station 4842, Dogo Island, Oki group, Sea of Japan.

Albatross station 5046, off Matsushima Bay.

Albatross station 5094, entrance to Gulf of Tokyo.

Araias ariommus has the eye-ball scaly. It is identical with *Dexistes rikuzenius* as stated by Jordan and Thompson.

Dr. C. H. Gilbert (MS.) made the following color notes on a specimen from station 4843:

Lower side of head except snout, all of abdomen on blind side, and a tapering area extending back on caudal peduncle silvery. Anteriorly this area includes more than half the distance between the lateral line and the dorsal outline, beginning to taper rapidly at origin of second half of its length.

Measurements in hundredths of length to base of caudal.

<i>Albatross station</i>.....	.....	.....	5094	5046	4842	4842	4842	4842
Dorsal rays.....	72	73	74	74	71	69	69	68
Anal rays.....	55	60	57	60	59	56	55	57
Pores.....	64	63	63	63	61	62	59	62
Gill-rakers.....	4+7	3+7	4+7	3+7	4+7	3+8	4+7	3+7
Length, mm.....	93	92	145	75	134	106	93	92
Length, head.....	25	27	23	27	24	26	26	27
Depth, body.....	39	40	41	36	34	37	38	36
Diameter, upper eye.....	8	9	8	9	7	9	8.5	9
Snout from upper eye.....	6	5.5	5	6	4.5	4.5	5	5
Maxillary, eyed side.....	7	8	7	8	7.5	8	8	8
Pectoral, eyed side.....	.....	15	14	13	12	12	13	13
Ventral, eyed side.....	9	10	9	9	8	10	10	10
Length, caudal.....	23	24	22	22	19	22	24	24
Height, dorsal.....	13	14	11	12	11	12	13	12
Height, anal.....	.....	14	11	12	11	12	13	12

The first specimen in the table is the paratype of *D. rikuzenius*, the second is the paratype of *A. ariommus*.

PLATICHTHYS STELLATUS (Pallas).

Pleuronectes stellatus PALLAS, Zoogr. Rosso-Asiat., vol. 3, 1811, p. 416.

Platichthys stellatus JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 218.

One specimen 177 mm. long, from the market at Korsakov, Aniwa Bay, Saghalin Island.

Dorsal, 53; anal, 47; gill-rakers, 4+8. The stellate prickles are rougher than in specimens from San Juan Island, Wash., but no rougher than in Alaskan specimens.

KAREIUS BICOLORATUS (Brasilewsky).

Platessa bicolorata BRASILEWSKY, Nouv. Mém. Soc. Moscow, vol. 10, 1855, p. 260.

Kareius bicoloratus JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 220.

Two specimens collected at Hakodate on July 8, 1906, by the Fisheries steamer *Albatross*.

Length.	Head.	Depth.	Eye.	Maxil- lary.	Snout.	Dorsal rays.	Anal rays.
<i>Mm.</i>							
296	3.38	2.17	6.9	3.7	.....	66	48
170	3.4	2.28	5.75	3.9	4.9	72	52

CLIDODERMA ASPERRIMUM (Temminck and Schlegel).

Platessa asperimma TEMMINCK and SCHLEGEL, Faune Jap., Poiss., 1846, p. 177.

Clidoderma asperrimum JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 221.

One specimen from *Albatross* station 4859, off east coast of Korea, Sea of Japan. Two specimens from *Albatross* station 5019, off the east coast of Sakhalin Island.

Length.	Dorsal rays.	Anal rays.	Head.	Depth.
<i>mm.</i>				
350	84	66	3.1	1.7
440	87	68	3.1	1.9
233	82	63	3.4	2.1

Three specimens from Mororan, Japan, collected by Jordan and Snyder, have the gill-rakers on the eyed side in each case 4 + 10; 2 specimens on the blind side have 4 + 10, the third 4 + 12. The 2 larger specimens collected by the *Albatross* have a few rudimentary gill-rakers on the anterior end of the lower arch, increasing the number on the eyed side to 4 + 12 or 13, on the blind side to 4 or 5 + 13 or 14; 1 specimen has other rudimentary gill-rakers between the developed ones on the lower arch. If these are counted, the number becomes about 4 + 18.

The 6 longitudinal rows of bony tubercles are less evident in the larger specimens than in the smaller, or in Jordan and Snyder's specimens from Mororan, 1 of which is figured by Jordan and Starks.

This species has a long dorsal branch to the lateral line, the pores on the eyed side opening on large papillae, those on the blind side present, but usually filled with mucus, rather difficult to see.

MICROSTOMUS STELLERI Schmidt.

Microstomus stelleri SCHMIDT, Pisc. Mar. Orient., 1904, p. 247.—JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 225.

Albatross stations 4807 and 4808, Tsugaru Strait, between Hondo and Hokkaido (Yezo).

Albatross station 5031, Yezo Strait, northeast of Hokkaido (Yezo).

Albatross station 5041, off south coast of Hokkaido.

Lower pharyngeals slender, as in *M. kitaharae* and in *Limanda*, with two rows of conical teeth.

The young are beautifully colored, as shown by two young specimens from *Albatross* station 4808, and one collected at Hakodate by Jordan and Snyder. A large dark spot on the lateral line just behind the pectoral and another between this and the base of caudal are ocellated with light (probably yellow in life), each of these spots surrounded by a pale area; about five large pale markings along base of dorsal, four along base of anal; dark mottlings below dorsal in broad zigzag lines bordering the pale areas; base of caudal pale, caudal darkly mottled; dorsal, anal, and pectoral of eyed side finely mottled, other fins pale; body mottled elsewhere. Only traces of these spots are found in adult specimens.

Measurements in hundredths of length to caudal base.

<i>Albatross station</i>	5031	5041	5041	5041	5041
Dorsal rays.....	86	92	87	91	91
Anal rays.....	70	74	72	72	73
Pores.....	124	116	124	117	124
Gill-rakers.....	7+8	7+9	6+10	7+9	7+9
Length, mm.....	238	243	208	205	202
Length, head.....	23	21	20.5	22	21
Depth, body.....	39	41	39	39	40.5
Diameter, upper eye.....	6	6	6	6	6.5
Snout from upper eye.....	5	5	4.5	5	5
Maxillary, eyed side.....	7	5.5	5.5	5	5
Pectoral, eyed side.....	16	15	13	13	16
Ventral, eyed side.....	7	7	7	6.5	7
Length, caudal.....	20	20	20	20	20
Height, dorsal.....	11	10	10	9.5	10
Height, anal.....	10.5	10	9.5	9.5	10

MICROSTOMUS KITAHARAE Jordan and Starks.

Microstomus kitaharae JORDAN and STARKS, Bull. U. S. Fish Comm., vol. 32, 1902 (1904), p. 625, pl. 7, fig. 2. Matsushima Bay.

Albatross stations 4816 and 4817, near Sado Island, Sea of Japan.

Albatross station 4832, off Tsuruga, Sea of Japan.

Albatross station 4842, near Dogo Island, Oki Group, Sea of Japan.

Albatross station 4856, off east coast of Korea, Sea of Japan.

Albatross station 4989, west coast of Hokkaido, Sea of Japan.

Albatross stations 5047 and 5048, off Matsushima Bay.

Albatross stations 5092 and 5094, entrance to Gulf of Tokyo.

M. kitaharae is readily separable from *M. stelleri*, differing as follows, the measurements expressed in hundredths of length:

	<i>M. kitaharae.</i>	<i>M. stelleri.</i>
Depth of body.....	0.27 to 0.33.....	0.39 to 0.41.....
Fin rays.....	D., 84 to 99; A., 75 to 82.....	D., 86 to 91; A., 70 to 74.....
Length of pectoral.....	0.10 to 0.14, more rounded.....	0.13 to 0.16, more pointed.....
Caudal.....	Doubly truncate.....	Rounded.....
Dorsal outline of head.....	Straight or convex.....	Concave.....
Skin, especially on fin rays.....	Thin.....	Tough, leathery.....
Fin rays.....	Weak.....	Strong.....
Lateral line.....	Straight.....	With a low curve.....
Scales.....	Imbricate.....	Poorly imbricate.....
Pores.....	92 to 96; no accessory scales about pores.....	116 to 124; accessory scales about pores.....
Eye-ball.....	Scaly.....	Naked.....

Lower pharyngeals as in *Limanda*.

The change from the slender young with large eyes to the more robust adult with smaller eyes is especially well marked in this species.

The young have 3 or 4 irregular dark spots along the lateral line, 5 below base of dorsal and 4 or 5 above base of anal; about 9 spots on dorsal rays, about 7 on anal rays, with numerous smaller ones. These spots are not ocellated as in the young of *M. stelleri*. The spots disappear in the adult. In all specimens the caudal and the pectoral of eyed side are black toward their tips.

“In life, a series of small evenly spaced pearly-blue spots just within bases of dorsal and anal, 7 or 8 along dorsal, 5 or 6 along anal.”
(Dr. C. H. Gilbert’s color notes.)

Measurements in hundredths of total length to caudal base.

Albatross station	5048	5048	5047	5047	5092	5092	5047	5092	4816	5094
Dorsal rays	94	95	95	97	99	84	95	93	89	89
Anal rays	79	81	80	82	82	75	78	77	76	76
Pores	98	97	97	98	97	98	94	95	92	95
Gill-rakers	6+7	5+8	5+8	5+8	5+8	5+8	5+9	5+8	6+7	5+8
Length, mm	223	217	190	177	174	172	170	154	154	148
Depth, body	32	32	31	29	31	33	30.5	30	31	27
Length, head	20.5	20.5	19	19	20	21	21	22	19	21
Diameter, upper eye	5.5	6	5.5	6	7	6.5	8	8	7	8
Snout from upper eye	4	4	3.5	3.5	4	4	4	4.5	4	5
Maxillary, eyed side	5.5	5	5.5	5.5	5.5	5.5	5.5	6	5	6
Pectoral, eyed side	-----	9.5	10	9.5	14	13.5	12.5	12	12	10
Ventral, eyed side	5.5	6	6	6	7	7.5	7	6.5	6.5	6
Length, caudal	19	-----	18.5	17	20	22	20	18	20	17
Height, dorsal	11	1	10	10.5	10.5	11	11	11	11	10
Height, anal	9.5	9	10	9.5	10.5	11	11	11	11	10

GLYPTOCEPHALUS OSTROUMOWI Pavlenko.

Glyptocephalus ostroumowi PAVLENKO, Kazanĭ, Trd. Obšč. jest., vol. 42, 1910,
pl. 2, pp. 59–61, fig. 13 a, b.

Numerous specimens of this species were obtained at the following
Albatross stations:

- 4807, Tsugaru Strait, between Hondo and Hokkaido (Yezo).
- 4812, near Sado Island, Sea of Japan.
- 4826 and 4828, near C. Rokko, west coast of Hondo, Sea of Japan.
- 4834 and 4839, near Tsuruga, west coast of Hondo, Sea of Japan.
- 4843 and 4844, near Dogo Island, Sea of Japan.
- 4855, 4856, 4858, 4859, and 4868, off east coast of Korea.
- 4984, 4985, 4986, 4988, and 4989, off coast of Hokkaido.
- 4992, 4993, and 4994, off northwest coast of Hokkaido.
- 4999, 5000, Gulf of Tartary.
- 5010, Aniwa Bay, Sakhalin Island.
- 5042, off south coast of Hokkaido.

Professor Snyder has examined the description of *G. ostroumowi*,
and finds it identical with his *G. sasae*.¹

Color uniform deep brown, darker toward tips of vertical fins and
ventral of eyed side; tip of pectoral of eyed side dark; pectoral and
ventral of blind side usually colorless; the body, the vertical fins,
and sometimes the paired fins of the eyed side thickly punctulate.
The adult does not retain the markings of the very young, which
consist first of about 6 dark bars extended vertically across the
body and fins, these later becoming separated into a row on dorsal
and anal, a row at the base of each fin, and a row along the later-
al line, finally entirely disappearing.

¹ Proc. U. S. Nat. Mus., vol. 40, 1911, p. 548; vol. 42, 1912, p. 440, pl. 49, fig. 1.

Measurements in hundredths of length to base of caudal.

Albatross station.....	4999	5042	4988	4856	4808	4988	4843	4855	4868	4843
Dorsal rays.....	92	91	91	89	85	89	90	84	86	85
Anal rays.....	80	79	78	74	70	75	73	74	73	73
Pores in lateral line.....	108	105	105	109	100	104	107	109	100	102
Gill-rakers.....	4+8	4+7	4+9	4+8	4+9	4+8	4+8	5+9	4+10	4+9
Length without caudal, mm.....	270	208	202	191	186	178	167	157	150	145
Length, head.....	21	21	24	23	25	23	23	26	22	23
Depth, body.....	38	36	32	34	37	31	32	34	34	33
Diameter, upper eye.....	5.5	6	6.5	7	6.5	7	7.5	8	6.5	7.5
Snout, from upper orbit.....	5	4.5	5	5	5	6	5	6	4.5	5
Maxillary, eyed side.....	4	4	5	5	5	5	5	5.5	5	5
Pectoral, eyed side.....	15	12	13	14	14	13	13	13	13	16
Ventral, eyed side.....	9	8.5	8	8	9	8	8	8.5	9	9
Caudal.....	22	20	22	21	24	21	23	23	-----	23
Height, dorsal.....	12	11	13	14	13	11	13	13	12	15
Height, anal.....	12	11	12	13	12	11	12	12	12	14

Family SOLEIDAE.

Subfamily SOLEINAE.

ASERAGGODES KOBENSIS (Steindachner).

Solea (Achirus) kobensis STEINDACHNER, Reise Aurora, 1896, p. 218.

Aseraggodes kobensis JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 230.

Albatross stations 4946 and 4947, near Kagoshima, Kiushu.

Albatross stations 4961, 4963, and 4964, in Kii Channel.

Albatross station 5074, Suruga Gulf.

Measurements in hundredths of length from tip of rostral hook to base of caudal.

Albatross station.....	4946	4946	4963	5074	5074	5074
Dorsal rays.....	72	67	69	70	70	70
Anal rays.....	49	48	48	49	53	52
Pores from opposite gill-opening.....	61	63	60	61	56	56
Length to base of caudal, mm.....	89	71	59	73	72.5	71
Length, head.....	22	22	23	20	22	21
Depth, body.....	47	45	36	43	45	46
Diameter, upper eye.....	4	4	4	4	4	4
Snout, from upper orbit.....	7	8	8	8	8	8
Maxillary, eyed side.....	8	8	8	8	8	8
Height, dorsal.....	11	10	11	10	10	11
Length, caudal.....	20	20	23	19	21	22

Subfamily SYNAPTURINAE.

ZEBRIAS ZEBRINUS (Temminck and Schlegel).

Solea zebrina TEMMINCK and SCHLEGEL, Fauna Jap., Poiss., 1846, p. 186, pl. 95, fig. 1.

Brachirus zebra BLEEKER, Atlas Pleur., 1870, pl. 9, fig. 3 (not *Pleuronectes zebra* Bloch, the following species).

Zebrias zebrinus JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 232, fig. 26.

Two specimens from Nanao and Shimizu, Japan, collected by the Albatross. Head, 5.7 and 5.3; depth, 2.5; dorsal, 66 and 69; anal, 59 and 61; caudal, 16; scales equal to pores, from opposite gill-opening, 98 and 95.

ZEBRIAS ZEBRA (Bloch).

Pleuronectes zebra BLOCH, Ausl. Fische, vol. 3, 1790, p. 27, pl. 187.

Synaptura zebra DAY, Fishes of India.

Synaptura quagga RUTTER, Proc. Acad. Nat. Sci., Phila., 1897, p. 90 (not *Aesopia quagga* Kaup).

This East Indian species is close to *Z. japonicus*, but differs from that species at least in not having the bars on the dorsal and anal fins between the extensions of the body bars on these fins.

A specimen from Swatow, China, recorded as *Synaptura quagga* by Rutter, collected by A. M. Fielde (No. 1553, Ichthyological Collections of Stanford University), has head 5.2 in length without caudal; eye 5 in head; dorsal, 70; anal, 58; caudal, 18; caudal not closely united to dorsal and anal; interorbital scaly; no ocular tentacles.

No specimens were obtained by the *Albatross*.

ZEBRIAS QUAGGA (Kaup).

Aesopia quagga KAUP, Wieg. Archiv für Naturg., 1858, p. 98.

Synaptura quagga GÜNTHER, Cat. Fishes, vol. 4, 1862, p. 485.

A specimen from Hongkong, China, collected by Capt. William Finch (No. 9799 Ichth. Coll., Stanford University), is referable to the species called *Synaptura quagga* by Günther. Kaup's description applies more closely, especially in fin rays, to this species than to the preceding species, from which it is readily separable by the naked interorbital and by the ocular tentacle on each eye. Jordan and Seale, reporting on this specimen,¹ wrongly refer it to *Z. zebra*, placing *Z. quagga* in the synonymy of that species. Jordan and Starks² also refer *Z. quagga* to the synonymy of *Z. zebra* Bloch.

No specimens were obtained by the *Albatross*.

AESOPIA CORNUTA (Kaup.)

Aesopia cornuta KAUP, Wieg. Archiv für Naturg., 1858, p. 95.

C. Rutter, reporting on the fishes of Swatow, China, collected by Miss A. M. Fielde, recorded a specimen of *Aesopia* and one of *Zebrias zebra* under the name *Synaptura quagga* (Kaup). The specimen of *Aesopia* is 95 mm. in total length; dorsal, 79; anal, 60; caudal, 13; pores about 90 from opposite gill-opening; head about 5.3; depth, about 3; eye less than 6 in head. This specimen differs from Japanese specimens of *A. cornuta* of larger size, in the smaller eye and in the form of the dorsal filament, which is bifid at tip, the posterior branch short, the anterior branch long and slender, longer than the rest of the ray, the ray with filament about as long as head.

No specimens in the *Albatross* collections.

¹ Proc. Acad. Sci. Davenport, Iowa, vol. 10, p. 17, pl. 12.

² Proc. U. S. Nat. Mus., vol. 31, 1906, p. 232.

Subfamily CYNOGLOSSINÆ.

CYNOGLOSSUS INUSITA (Jordan, Tanaka, and Snyder.)

C. robustus JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 239 (not of Günther).

C. inusita JORDAN, TANAKA, and SNYDER, Journ. Coll. Sci., Imp. Univ. Tokyo, vol. 33, Art. 1, 1913, p. 335.

One specimen from station 4961, near Kobe; Dorsal, 127; anal, 97; caudal, 8, scales from opposite gill-opening, 74; head, 5; depth, 3.8.

This species has fewer dorsal rays (122 to 127) and fewer scales (69 to 74) than in Günther's description of *C. robustus*.¹

RHINOPLAGUSIA JAPONICA (Temminck and Schlegel).

Plagusia japonica TEMMINCK and SCHLEGEL, Fauna Jap., Poiss., p. 187, pl. 95, fig. 2.

Usinosita japonica JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 237.

Rhinoplagusia japonica JORDAN, TANAKA, and SNYDER, Journ. Coll. Sci., Imp. Univ. Tokyo, vol. 33, art. 1, 1913, p. 335.

Two specimens were collected by the *Albatross* at Nanao, Japan.

Head, 4.3; depth, 3.6; eye, 15 and 13.8; interorbital, 14.5 and 13.8; snout, 2.3 and 2.25; dorsal, 103 and 111; anal, 89 and 88; caudal, 7 and 6; scales from opposite gill-opening, 100 and 96.

ARELISCUS INTERRUPTUS (Günther).-

Cynoglossus interruptus GÜNTHER, Shore Fishes, *Challenger*, 1880, p. 70, pl. 30, fig. B.

One specimen from *Albatross* station 4948, near Kagoshima.

Dorsal, 107; anal, 81; caudal, 14; ventral, 4; 58 pores in the lateral line.

An *Areliscus*, only 12 mm. long, from the surface, station 4897, Eastern Sea, has both eyes sinistral, and has 3 lateral lines.

SYMPHURUS HONDOENSIS, new species.

Plate 27, fig. 9.

This species differs from the following, *S. orientalis*, in the greater number of fin rays (dorsal, 112; anal, 96; caudal, 12, instead of dorsal, 93 to 100; anal, 81 to 86; caudal, 12 to 14; in the finer scales (105 rather than 85 to 90 between the upper angle of the branchial aperture and base of caudal); in the larger eye (6.5 rather than 7 to 8 in head); in the more vertical and less rounded snout; in the greater curvature of the mouth; in the more oblong or less lanceolate form; and in the color, especially in lacking the bands.

¹ Ann. Mag. Nat. Hist., 1873, p. 243. Shanghai. D. 130; scales 83.

Type-specimen.—Cat. No. 75675, U.S.N.M., a male 120 mm. long, from *Albatross* station 5066, in Suruga Gulf, Japan, collected on October 15, 1906, at a depth of from 211 to 293 fathoms.

Length of head, from tip of rostral hook to upper angle of branchial aperture, 0.17 of total length to base of caudal; depth of body, 0.27; dorsal, 112; anal, 96; caudal, 12; ventral, 4; 105 series of scales between upper angle of branchial aperture and caudal base, 47 in a transverse series between first anal rays and the dorsal fin.

Head rather evenly rounded, the snout being nearly vertical from the tip of rostral hook to origin of dorsal; eyes small, the upper slightly in advance of the lower, its diameter 0.03; interorbital nearly obsolete, with a few scales, a few scales also on eyeball; length of snout from upper orbit to tip of rostral hook, 0.05; anterior nostril of eyed side in a slender tube, its length about half the diameter of eye, placed midway on a line joining the posterior nostril and tip of rostral hook, posterior nostril of eyed side between anterior margins of orbits, opening through a broad, rather low tube; nostrils of the blind side similar to those of eyed side, the anterior with a shorter tube, the posterior with an anterior flap; mouth strongly curved, small, the maxillaries reaching to below anterior edge of lower pupil; length, 0.04; teeth very slender and sharp, in a band of about four rows confined to the blind side of jaws.

Body elongate-elliptical, moderately compressed, its width about 5 in its depth; tip of mandible to anus, 0.22; anus on blind side; depth of caudal at base, 0.04.

Scales ctenoid on both sides. Lateral line absent, the median line slightly grooved.

Origin of dorsal on snout in advance of upper eye about three-fourths of its diameter, the first rays well separated, becoming more crowded posteriorly, so that there are only 11 rays anterior to the vertical of the upper angle of branchial aperture, while there are 24 rays in the same length of base at the end of the fin; height of dorsal nearly uniform, 0.07; anal similar, the first 2 rays thickened and joined; length of caudal, 0.09, rather pointed; ventral fin single, on the preanal ridge, deflected toward the blind side under the united gill membranes.

Color of both sides uniform brown, the snout and caudal fin pale, the dorsal and anal fins dusky, the ventral fin pale; peritoneum black, showing distinctly through body. Color of *S. orientalis*, as described by Bleeker:

Color of the body on the eyed side dusky-green, median opercular region with a diffuse band, trunk diffusely and darkly clouded and transversely subfasciate; fins dusky, ventral somewhat yellowish; iris greenish-yellow; color of blind side whitish; fins dusky on distal half.

SYMPHURUS ORIENTALIS (Bleeker).

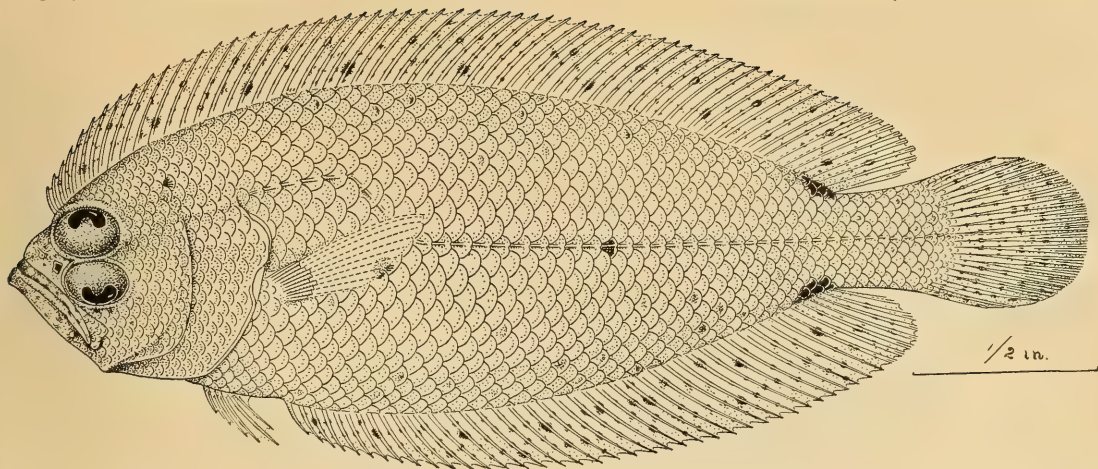
Aphoristia orientalis BLEEKER, Enum. Poiss. Connus du Japon, 1879, p. 31, pl. 2, fig. 1. Japan.

Symphurus orientalis JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 243.

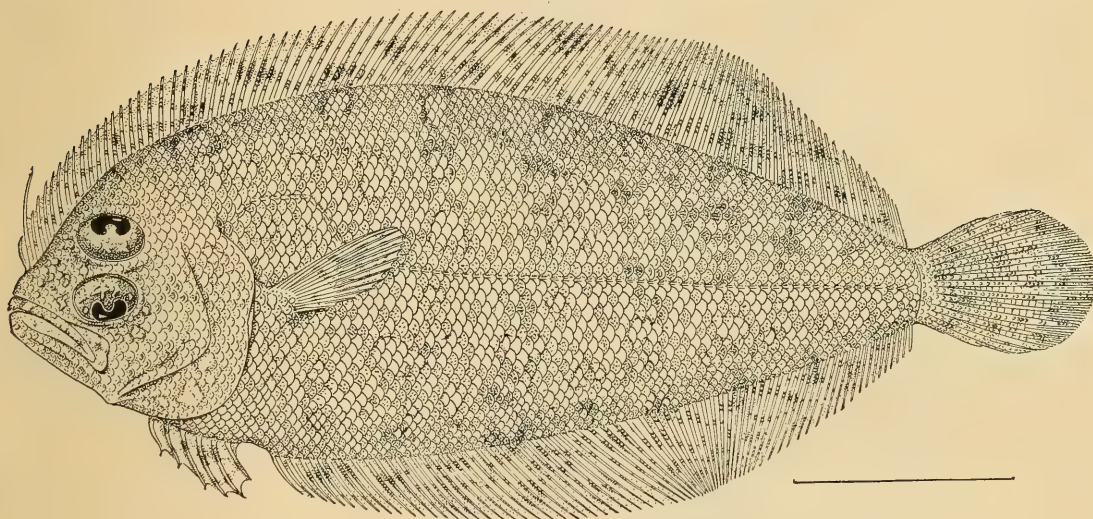
One specimen, 57 mm. long, from *Albatross* station 5072, in Suruga Gulf, depth 148 to 284 fathoms.

Dorsal, 93; anal, 81; caudal, 14; ventral, 4; 85 scales between upper angle of branchial aperture and caudal base, 34 in a series between first anal ray and dorsal fin; diameter of upper eye 7 in head.

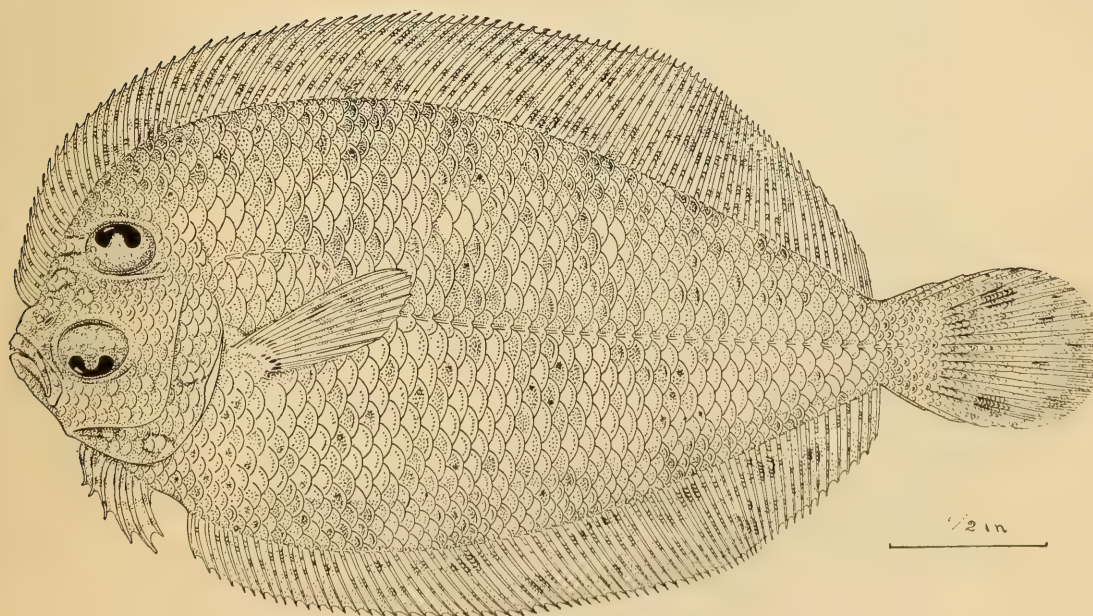
This appears to be the second time this species has been recorded.



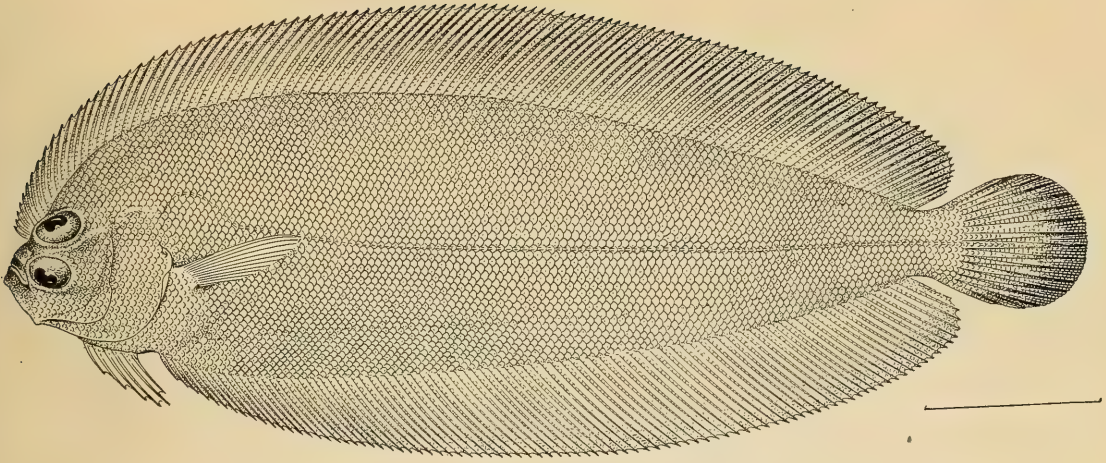
1. CITHAROIDES MACROLEPIDOTUS. (PAGE 453.)



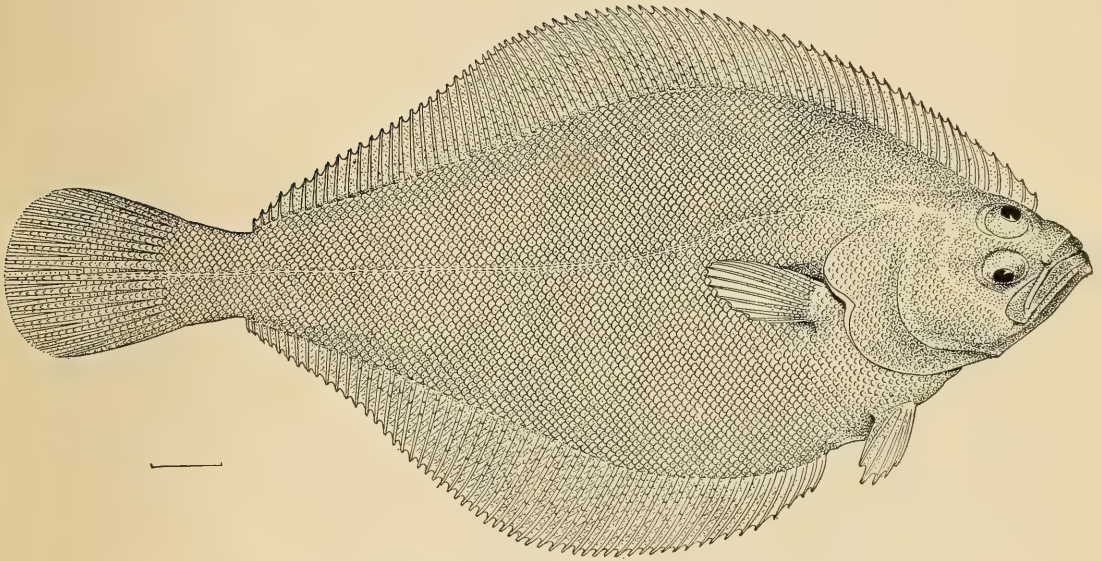
2. ARNOGLOSSUS JAPONICUS. (PAGE 454.)



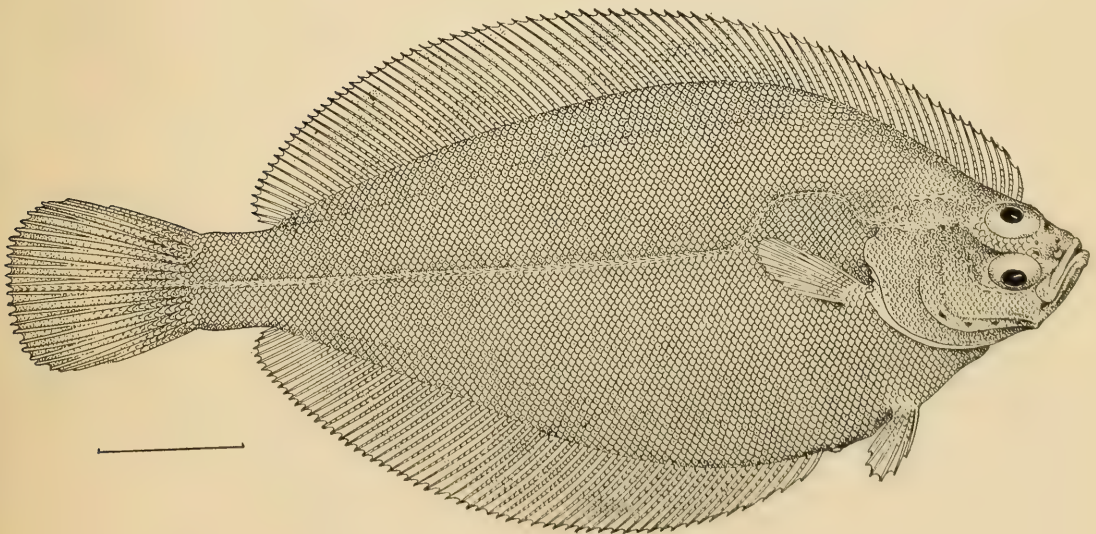
3. ENGYPROSOPON XYSTRIAS. (PAGE 457.)



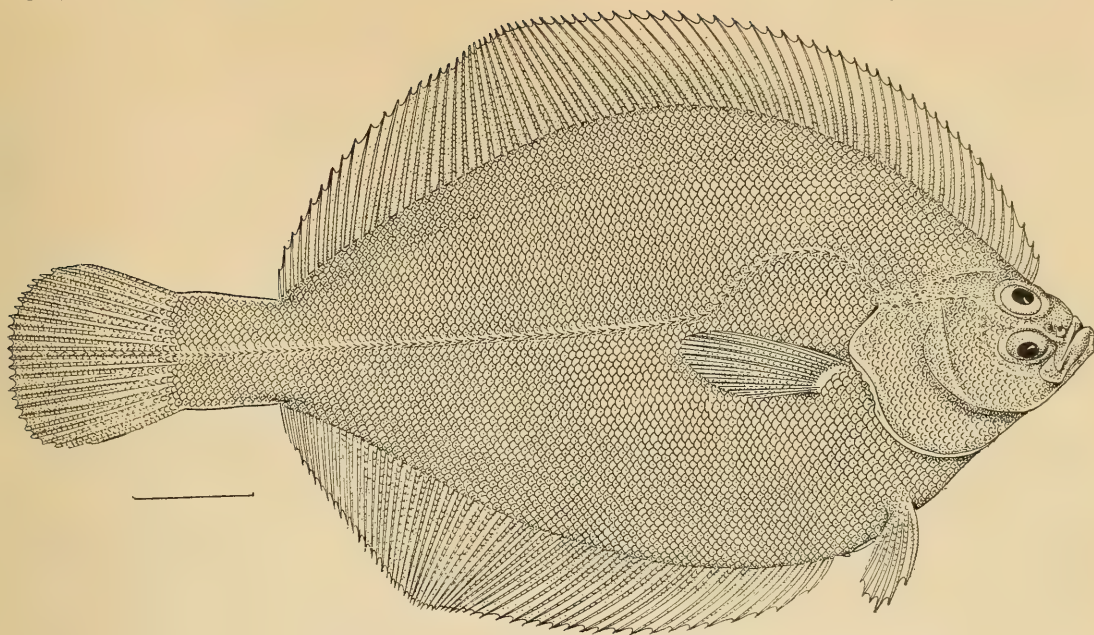
4. *LAEOPTICHTHYS FRAGILIS*. (PAGE 460.)



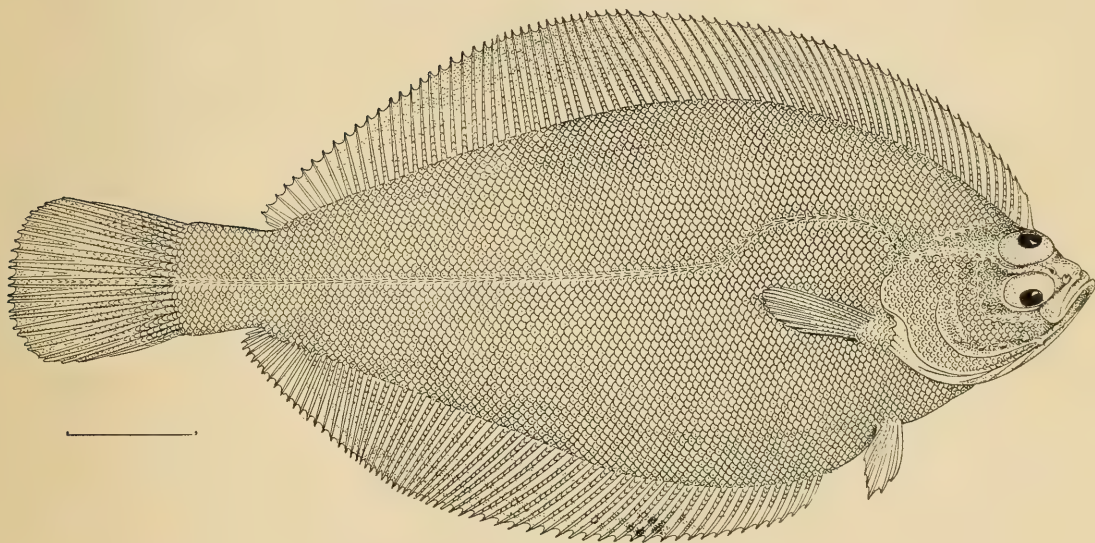
5. *HIPPOGLOSSOIDES PROPINQUUS*. (PAGE 469.)



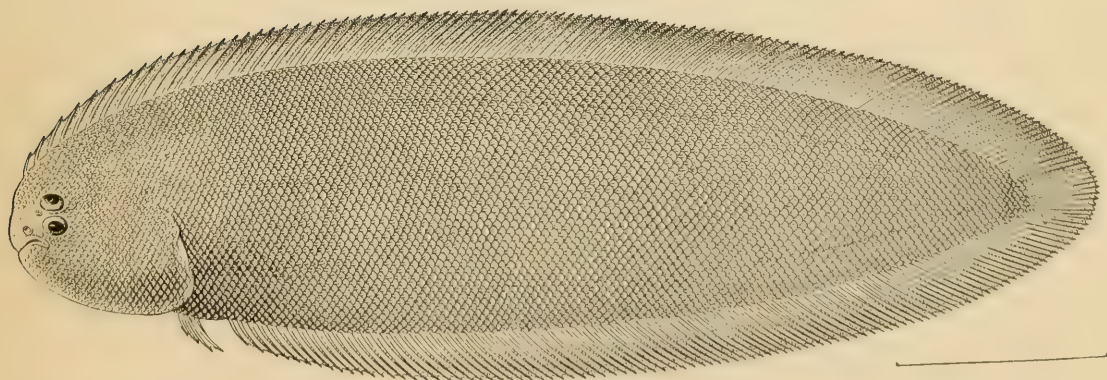
6. *LIMANDA SAKHALINENSIS*. (PAGE 480.)



7. LIMANDA ASPRELLA. (PAGE 482.)



8. LIMANDA KORIGAREI. (PAGE 483.)



9. SYMPHURUS HONDOENSIS. (PAGE 494.)

NOTES ON SOME SAWFLY LARVAE BELONGING TO THE GENUS DIMORPHOPTERYX.

By WILLIAM MIDDLETON.

Of the Bureau of Entomology, United States Department of Agriculture.

The following account, which is a contribution from the Branch of Forests Insects, Bureau of Entomology, deals with the known larvae of the sawflies belonging to the genus *Dimorphopteryx*, and has been prepared under the writer's direction by Mr. Middleton, who was assigned to assist in the rearing of Forest Hymenoptera. It has been Mr. Middleton's duty to make notes and care for the rearing material of the species of this genus, and for this reason he has been requested to work over the notes available and prepare them for publication to follow a synopsis of the adults. Special attention has been paid to the specific differences in the larvae at hand, to add additional proof as to the validity of the species founded on adult characters. Brief statements describing the type of work, the time of appearance of the larvae, and methods of pupation have been added, to aid collectors and to convey an idea of the seasonal history of these insects.—*S. A. Rohwer*.

GENUS DIMORPHOPTERYX.

Characters of immature stages common to species studied.

Egg.—The egg of one species has been described by Doctor Dyar, and the egg-laying habits of the other species are no doubt similar.

"[Eggs deposited] under the upper epidermis [of leaf] in an irregularly elliptical area [approximately] 1.7 mm. by 1.4 mm., transparent, overlaid by the reticulations of the epidermal cells. Before hatching the larva swells up somewhat and a ring of air forms around it, appearing like a white margin." Dyar, Journ. N. Y. Ent. Soc., vol. 5, 1897, p. 199.

The following characters of the larva, prepupa, and cocoon are common to all of the species studied.

Larva.—Shape sluglike, not slimy; many distinct annulations; skin dull, finely granular. Head higher (dorsad-ventrad) than broad; eyes in dark spots; antennae 5-jointed. Thorax: The lateral or pleural folds lobed and tuberculate; legs 4-jointed, the fourth joint modified into a claw. Abdomen: Intermediate segments

6-annulate (fig. 1); pleural fold lobed and tuberculate; prolegs somewhat reduced, on segments 6-12 and anal; anal segment with a pair of subanal protuberances (they are subdorsal and basad of the anal plate); plate armed apically with 4 spines, the median ones called the subdorsal pair, the lateral ones, the lateral.



FIG. 1.—LATERAL VIEW OF SEVENTH (THIRD ABDOMINAL) SEGMENT OF DIMORPHOPTERYX CASTANEAEE.

Prepupa.—Similar to larva, though more concolorous. Head pale and more nearly round than that of larva, being somewhat depressed. Thorax: Pleural fold not distinctly lobed and not tuberculate; prothoracic and mesothoracic protuberances present but much reduced. Abdomen: Pleural fold not distinctly lobed and not tuberculate; pair of subanal protuberances nearly obsolete; armature of apical plate much reduced, becoming tuberculate.

Cocoon.—No cocoon is spun; pupation occurs in a capsule-shaped cell in soil. The size of cell is approximately 7 mm. long by 2.5 mm. in diameter.

Synopsis of the larvae studied.

Head dorsally prominent and conelike, considerably blackened at apex (see fig. 2); prothoracic and mesothoracic protuberances concolorous, pale yellowish. Host: *Castanea dentata*.....*castaneae* Rohwer
Head rounded, not prominent and conelike, darkened but faintly at apex (fig. 3); prothoracic protuberances whitish or slightly darkened, mesothoracic protuberance black. Host: *Quercus* species.....1.

1. Prothoracic protuberances slightly darkened, projecting from whitish portion of segment; lateral anal spines nearer to subdorsal spine than subdorsal spines are to each other (fig. 4); emargination between subdorsal spines U shaped, emargination between lateral and subdorsal spines V shaped. Host: *Quercus rubra*.

autumnalis Rohwer

Prothoracic protuberances whitish, projecting from faintly darker, subdorsal lines; subdorsal anal spines closer together than to lateral spine; emargination between the subdorsal spines sharply V shaped, between lateral and subdorsal, sub-U-shaped. Host: *Quercus rubra*.....*quercivora* Rohwer

DIMORPHOPTERYX CASTANEAEE Rohwer.

Plate 28.

Host.—*Castanea dentata*.

Larva.—All the stages have been determined from the study of a single larva but additional characters from other larvae examined have been incorporated.

Stage I.—Length, 4.5 mm.; prothoracic width, 0.875 mm.; head, 0.875 mm. high (dorsad-ventrad length) by 0.5 mm. broad, below

eyes brown; top black capped; mandibles brown; thoracic protuberances present, mesothoracic one slightly smaller than prothoracic pair; dull golden yellowish green, alimentary canal colored dark olive green; subdorsal anal spines black tipped.

Stage II.—Length, 5.5 mm.; prothoracic width, 1 mm.; head, 1 mm. high by 0.67 mm. broad; general appearance same as first stage.

Stage III.—Length, 8 mm.; prothoracic width, 1.25 mm.; head, 1.33 mm. high by 0.875 mm. broad; general appearance the same.

Stage IV.—Length, 9.5 mm.; prothoracic width, 1.5 mm.; head, 1.67 mm. high by 1.13 mm. broad; general appearance the same.

Stage V.—Length, 10.5 mm.; prothoracic width, 1.75 mm.; head, 2 mm. high by 1.5 mm. broad; general appearance the same.

Stage VI.—Length, 15 mm.; prothoracic width, 2.33 mm.; head, 2.5 mm. high by 2 mm. broad, otherwise the same; prothoracic protuberances large and prominent, twice as high as thick; mesotho-



FIG. 2.—ANTERIOR ASPECT OF HEAD OF DIMORPHOPTERYX CASTANEAE.

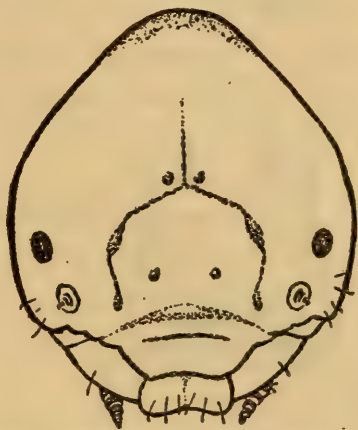


FIG. 3.—ANTERIOR ASPECT OF HEAD OF DIMORPHOPTERYX AUTUMNALIS.

racic protuberance slightly smaller; pleural region and anal plate bright (not shiny) yellow; dorsum (alimentary canal) dark green and separated from yellowish pleural region by blackish lateral lines running posteriorly from base of each yellowish prothoracic protuberance, to and including the large pair of white-tipped subanal protuberances, where they meet in a transverse band; anal spines black.

Stage VII.—(Prepupa). Length, 11.5 mm.; prothoracic width, 2.5 mm.; head, 2 mm. high by 2 mm. broad, dark above, not black, pale below antennae and about mouth, antennae dark, mandibles brownish; armature of anal plate reduced to tubercles, subdorsal pair as widely separated as in sixth stage, but united basally with the nearest lateral tubercle; skin yellow; spiracles slightly darkened in undarkened pleural band.

Remarks.—The larvae of this sawfly, in the first three stages, feed upon the upper epidermis and parenchyma of the chestnut leaves, but from the fourth to the sixth they characterize their work by

eating holes through the leaves.¹ They appear in the latter part of July and disappear in the latter part of September. The larvae average about 5 days a moult, the last feeding stage being the longer. Upon becoming prepupae the larvae cease to feed, but crawl about, seeking a favorable hibernating place. The adults emerge in early summer the following year, May 30 to about June 10, in the rearing cages.

Material of this species from the following localities has been studied: Falls Church and Wiehle, Virginia; and Blythedale, Maryland.

DIMORPHOPTERYX AUTUMNALIS Rohwer.

Host.—*Quercus rubra*.

Larva.—Younger stages are characterized from shed skins; the more advanced stages from one larva with additions from another.

Stage I.—Head, 0.875 mm. high by 0.5 mm. broad.

Stage II.—Head, 1 mm. high by 0.67 mm. broad.

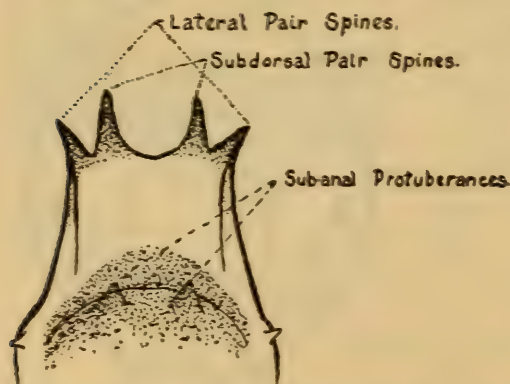


FIG. 4.—DORSAL VIEW OF ARMATURE OF APICAL SEGMENT OF DIMORPHOPTERYX AUTUMNALIS.

Stage III.—Head, 1.33 mm. high by 0.875 mm. broad.

Stage IV.—Head, 1.67 mm. high by 1.13 mm. broad.

Stage V.—Length, 11.5 mm.; prothoracic width 2 mm.; head 2 mm. high by 1.5 mm. broad; prothoracic protuberances prominent, higher than thick basally; mesothoracic protuberance low and rounded; subanal pair protuberances sharply pointed, high as

basal width, approximate emargination between V-shaped; anal spines long and sharp, 4 times as long as basal width; head uniformly rufo-ferruginous; dorsum, dark bluish green, sharply separated from paler pleural region and sternum but not with black lines; tip of mesothoracic protuberance, anal spines, subanal protuberances and basal area of anal plate black, being the only black portions on larva; legs testaceous.

Stage VI.—Head, 2.5 mm. high by 2 mm. broad; anal spines subequal in length; body red, dorsum darker and with a pair of darker red subdorsal lines; prothorax and protuberances pale red; anterior annulation of mesothorax and its protuberance black; small tubercles on pleural fold, white; anal spines black.

Stage VII.—(Prepupa). Length (alcoholic specimen), 7 mm.; head, 2.5 mm. high by 2.25 mm. broad; apical armature of anal plate reduced to four rounded humps; subanal protuberances present

¹ Similar work is often caused by the feeding of nymphs of long horn grasshoppers of the genus *Scudderis* (determined Caudell).

but small; body red; dorsum somewhat darker; feet pallid; head pinkish, slightly darkened dorsally.

Remarks.—The larvae of this sawfly are, in the summer, green, but with the reddening of the leaf petioles they become reddish. They feed similarly to the chestnut species, the younger larvae eating only the upper epidermis and parenchyma, the more advanced eating holes through the leaves. The prepupa never feeds, but crawls around in search of a suitable place for pupation. The larvae appear about the middle of August and usually enter the ground during early October. The adults emerge during early June of the following year, in rearing cages.

Material of this species has been collected at Falls Church and Wiehle, Virginia.

DIMORPHOPTERYX QUERCIVORA Rohwer.

Host.—*Quercus rubra*.

Larva.—The only description available is that made by Mr. S. A. Rohwer in the field, September 9, 1912, at Tomahawk Lake, Wisconsin. Prothoracic proturbances separated basally by their length; body reddish; dark reddish black, dorsal line very faint; head red with faint indication of small dorsal black spot.

Remarks.—Very little is known of the larvae of this species. The material was found in advanced stages eating holes through leaves and, becoming prepupae, disappeared into the ground in the latter part of September. The adults emerged in breeding cages late in June of the following year.

The field observations on this species were made at Tomahawk Lake, Wisconsin, while the rearing was done at Falls Church, Virginia.

DIMORPHOPTERYX ERRANS Rohwer.

Host.—Birch and linden (teste Dyar).

Egg.—Laid in nearly circular saw cuts under the upper epidermis in the middle of the leaf.¹

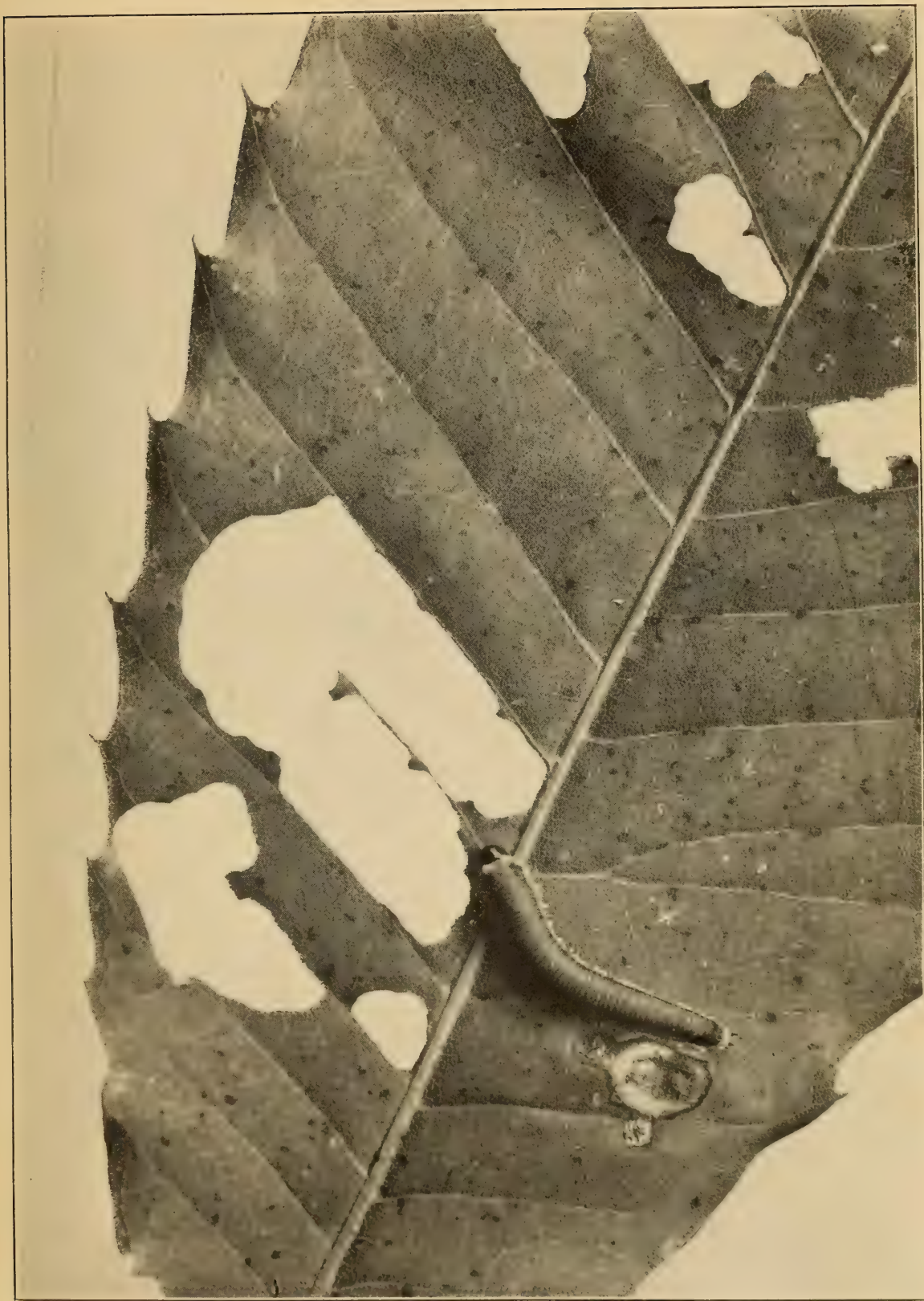
Larva.—The I-II, and IV-VII stages of larvae were described by Dyar,¹ but under heading I?, II?, III-VI. See correction,² which may not refer to this species, but is sufficient to establish the error in the naming of the stages.

EXPLANATION OF PLATE 28.

Dorsal view of living fifth or sixth stage larva and work of *Dimorphopteryx castaneae* Rohwer.

¹ Dyar, Trans. Amer. Ent. Soc., vol. 22, 1895, p. 311.

² Journ. N. Y. Ent. Soc., vol. 5, 1897, p. 199.



LIVING LARVA OF DIMORPHOPTERYX CASTANEA.

FOR EXPLANATION OF PLATE SEE PAGE 501.

THE FISHER, POLK COUNTY, MINNESOTA, METEORITE.

By GEORGE P. MERRILL,

Head Curator, Department of Geology, United States National Museum.

In the *American Geologist* for December, 1894, brief mention is made of the finding near Fisher, Polk County, Minnesota, of a meteoric stone weighing $9\frac{1}{2}$ pounds. This, the first found within the State limits, was assumed to be a representative of a reported fall which took place on the 9th of the preceding April. In a subsequent number of the *Geologist*, Prof. N. H. Winchell began a petrographic description of the stone, which was continued over into volume 20, 1897, but not completed, nor was a satisfactory chemical analysis made.¹ In view of these facts and the subsequent finding of more material, a complete reviewal of the matter seems desirable.

According to Professor Winchell there had been found at the time he wrote but two stones, one, the $9\frac{1}{2}$ -pound mass mentioned above, and one, weight unknown, "but larger," which was broken up and largely lost, though several pieces passed into the possession of Dr. George F. Kunz. Later three other individuals were found, one of which, a beautifully perfect stone weighing 1,312 grams, came into the possession of the United States National Museum. The following information concerning the fall and finding of these pieces was furnished the writer by Mr. C. J. Sweet:

On that date [that is, April 9, 1894] persons in the neighborhood of here [Fisher] heard a loud explosion followed by a hissing noise as of steam escaping from high pressure, and then a thud as if something had struck the earth very solidly. Of course nothing was known of the cause of the disturbance at this time, but in the summer following a black stone was found which proved to be a meteorite of $9\frac{1}{4}$ pounds weight. This piece was sold to the Minnesota State University, the authorities there claiming it the first which was ever found in this State. The next summer (1895) two small pieces of the same meteorite were found by me and sold to a firm in New York. This summer (1898) I found another piece when breaking up a new field. This piece weighs slightly less than 3 pounds.

In addition to information furnished as above, I am informed by Dr. E. O. Hovey that there is in the American Museum of Natural History, New York, "a beautiful specimen of Fisher, Polk County,

¹ See *American Geologist*, vol. 14, 1894, page 389; vol. 17, 1896, page 173; and vol. 20, 1897, page 316.

Minnesota, aerolite approximately 16.4 cm. by 10.6 cm. by 8.1 cm., weighing 1,765 grams, with crust well preserved. One curved surface shows the original crust and there are about six fractured surfaces showing a secondary, tertiary, or perhaps quarternary crust with pittings and flowage lines." Doctor Hovey further states that a second mass from the same source, weighing 1,850 grams, was sent by the American Museum to Doctor Gottsche of Hamburg. These two stones were originally in the possession of Dr. G. F. Kunz and are beyond doubt the two found in 1895 as mentioned by Mr. Sweet above. A third fragment, weighing 28 grams, he also records as having passed in 1913 into the hands of the dealer, W. M. Foote, and 22 grams are listed by Doctor Berwerth in his collections in the Vienna Museum. Dr. O. C. Farrington reports, in answer to inquiry, that the Field Museum collections include three fragments weighing, respectively, 133, 185, and 277 grams. Two of these are doubtless from the Ward-Coonley collection mentioned in the catalogue of 1904. It would seem practically certain that all of these fragments were from the larger mass mentioned by Winchell, the principal portion of which is lost. The distribution and weights as known to-day are then as follows:

	Grams.
University of Minnesota, Minneapolis	¹ 4, 340
United States National Museum, Washington	² 1, 300
American Museum, New York	1, 765
Natural History Museum, Hamburg.....	1, 850
Field Museum, Chicago.....	595
Vienna Museum, Austria.....	22
W. M. Foote, Philadelphia.....	28
Total.....	9, 900

Through the courtesy of Prof. W. H. Emmons of the University of Minnesota, the writer has had the opportunity of examining the stone in the possession of that institution and was also granted permission to cut from it a sufficient amount to guarantee its identity with that in the Museum collections and to supplement sufficiently that cut from our own specimen to insure a satisfactory chemical analysis.

The general appearance of the stone on a broken or polished surface is closely similar to that of Forest City, Iowa, and still more to that of Coon Butte, Arizona.³ The stone is of a compact texture, sufficiently firm to admit of a polish, of a light gray color, and is thickly spotted with metallic points in sizes up to 3 mm. in diameter with numerous small, distinct, light gray chondrules and more rarely larger (2 mm.) white forms. Each specimen examined shows one curved, crusted area, with few distinct pittings, evidently a portion

¹ 4,390, when found. ² 1,312, when found. ³ J. W. Mallet, *Am. Journ. Sci.*, vol. 21, May, 1906, p. 347.

of the surface once continuous over the entire mass (A in plate). The remaining surfaces, which are plainly due to the fracturing of the stone in the lower atmosphere, are characterized by shallow pits. All are coated with a black, lustreless, somewhat rough coating caused by the unequal fusibility of the various constituents. This is plainly shown in the half tone reproductions from the photographs. Three crusts are recognizable (1) that first formed (A in plate), (2) a thinner crust covering the earliest fractures, and (3) a very thin crust covering limited areas of secondary fracture. I find no certain evidence of a quarternary coating, as mentioned by Doctor Hovey, on the specimen in the American Museum.

Under the microscope the stone is found to consist of a confused aggregate of irregular crystalline granules of olivine and pyroxene interspersed with numerous imperfectly outlined chondrules, consisting also of olivine and pyroxene, throughout which are occasional interstitial areas occupied by a colorless, pellucid, faintly doubly refracting or quite isotropic material, referred to maskelynite. Small areas of nickel and iron sulphide complete the list of determinable minerals. The chondrules are sometimes wholly of pyroxene, either in stout irregular crystals or in fan-shaped and dendritic forms, and sometimes of olivine, the latter also in barred and radiating forms. Both types of chondrules contain numerous inclosures of the colorless mineral mentioned above. No truly porphyritic forms were noted. The pyroxenes all give parallel extinctions and are devoid of twin structure. The colorless interstitial material seems sometimes quite isotropic or again faintly doubly refracting, with an index of a refraction of but 1.51 as determined by the immersion method.¹

A chemical analysis on materials selected to insure its representative character, yielded Dr. J. E. Whitfield results as below:

	Per cent.
Metallic constituents.....	11.44
Silicate constituents	88.56

The silicate portion yielded:

	Per cent.
Silica, SiO ₂	43.70
Alumina, Al ₂ O ₃	4.96
Ferrous oxide, FeO.....	18.27
Manganous oxide, MnO.....	0.38
Nickel oxide, NiO.....	0.23
Lime, CaO.....	2.19
Magnesia, MgO.....	29.38
Chromite, FeO.Cr ₂ O ₃	0.80
	<hr/> 99.91

¹ It should be noted in this connection that Professor Winchell, in the description above referred to, noted the mineral composition essentially as I have given it.

The chromium present is tabulated as chromite, as it occurs as such in the stone. No barium, strontium, zirconium or potassium could be detected by analysis.

The metallic portion freed from the last trace of siliceous matter contained:

	Per cent.
Iron, Fe.....	85.00
Nickel, Ni.....	14.15
Cobalt, Co.....	0.74
Copper, Cu.....	Trace.
	<hr/> 99.89

On recalculating, these figures give the bulk or mass composition of the stone as follows:

	Per cent.
Silica, SiO_2	38.70
Alumina, Al_2O_3	4.39
Ferrous oxide, FeO	16.18
Manganous oxide, MnO	0.336
Nickel oxide, NiO	0.204
Lime, CaO	1.939
Magnesia, MgO	26.018
Chromite, $\text{FeO} \cdot \text{Cr}_2\text{O}_3$	0.708
Metallic iron, Fe.....	9.724
Metallic nickel, Ni.....	1.618
Metallic cobalt, Co.....	0.084
Total.....	<hr/> 99.901

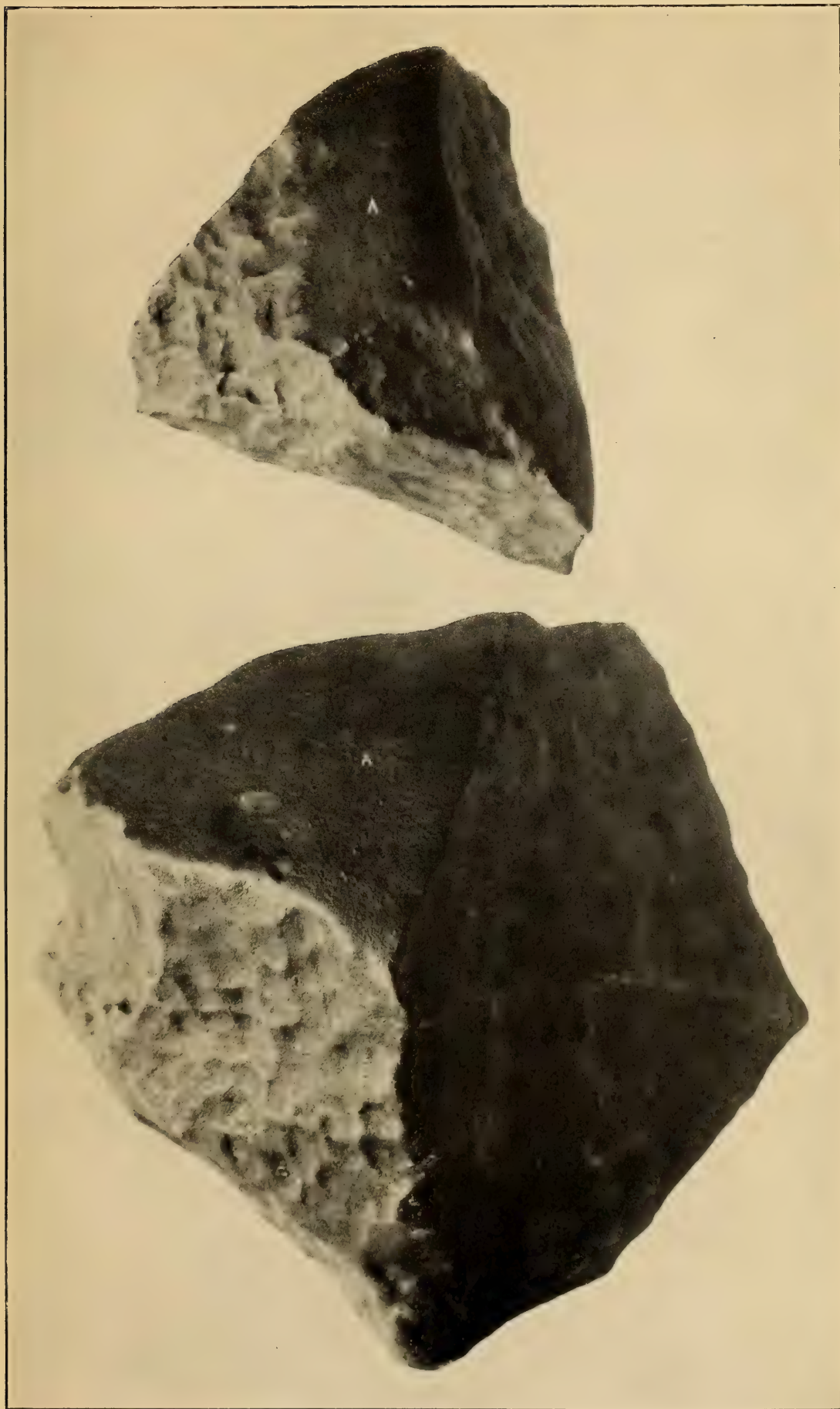
With traces of sulphur and soda but none of barium, strontium, zirconium, or potassium. Specific gravity, 3.37. Following Brezina's classification the stone would be placed in the group of intermediate chondrites Ci, or perhaps Cia, as one cut surface shows a small threadlike black vein.

EXPLANATION OF PLATE 29.

FIG. 1. The 1,300-gram piece in the United States National Museum, Cat. No. 212.

2. The 4,340-gram piece in the museum of the University of Minnesota.

In both figures the areas marked "A" show the earliest formed crust, the other pitted surfaces, the secondary and tertiary crusts.



THE FISHER, POLK COUNTY, METEORITE.

FOR EXPLANATION OF PLATE SEE PAGE 506.

DESCRIPTIONS OF SIX NEW SPECIES OF ICHNEUMON-FLIES.

By R. A. CUSHMAN,

Of the Bureau of Entomology, United States Department of Agriculture.

The present paper deals largely with insects of economic importance, here described in order to have names available for use in discussions of their host relations in economic papers.

Family BRACONIDAE.

Genus BASSUS Fabricius.

As shown by Viereck in his "Type Species of the Genera of Ichneumon-flies,"¹ the genus *Microdus* Nees² is isogenotypic with *Bassus* Fabricius,³ while the *Bassus* of authors is *Anomalon* Jurine⁴ and *Anomalon* of authors is *Paranomalon* Viereck.⁵ He also reduced *Diplazon* (Nees) Gravenhorst⁶ to synonymy with *Anomalon* Jurine on the ground that it is isogenotypic with that genus. He, however, overlooked the fact that Panzer⁷ had used the name *Anomalon* for his *cruentatus* two years before it was proposed by Jurine. *A. cruentatus* is unrecognisable.

Viereck's genotype list should, therefore, be amended to read as follows:

(*Anomalon* Authors) = **Paranomalon** Viereck.

(*Anomalon* Jurine) = **Diplazon** (Nees) Gravenhorst.

Anomalon Panzer.

Fauna Ins. German., 1805, Heft 94, pl. 15.

Type.—*Anomalon cruentatus* Panzer. (Monobasic.)

(*Bassus* Authors) = **Diplazon** (Nees) Gravenhorst.

Diplazon (Nees) Gravenhorst (= *Anomalon* Jurine, preoccupied).

The species described below is a representative of the genus *Bassus* in its true sense.

¹ Bulletin 83, U. S. Nat. Mus., 1914.

² Nov. Act. Acad. Nat. Curios., vol. 9, 1818, p. 304.

³ Syst. Piez., 1804, p. 93.

⁴ Nouv. Math. Class. Hym., 1807, p. 114, pl. 3, fig. 2.

⁵ Proc. Ent. Soc. Wash., vol. 14, 1912, p. 175.

⁶ Nov. Act. Acad. Nat. Curios., vol. 9, 1818, p. 292.

⁷ Fauna Ins. German., 1805, Heft 94, pl. 15.

BASSUS CARPOCAPSAE, new species.

Female.—Length, 4.5 mm. Black with abdomen (except first tergite, which is black) and legs rufous. Head with orbits, sides of face, and clypeus testaceous, middle of face, vertex, and occiput black; face densely and vertex sparsely, finely punctured; mouth parts (except tips of mandibles, which are black) pale fulvous; scape and pedicel reddish-piceous, tip of pedicel paler, flagellum black; mesonotum and scutellum sparsely, finely punctured, notauli strongly crenulate; propodeum with a short median elevation at base, disk strongly, finely reticulate, laterally more coarsely reticulate; fore and middle legs entirely rufous; hind legs darker with base of coxae shading into black, apex of tibiae and first three tarsal joints ringed with fuscous; wings tinged with brown, nervures and stigma brown, the latter with a pale spot at base; tegulae pale brownish; first tergite black bordered apically and laterally with rufous, rather coarsely aciculate throughout; remaining tergites smooth, shining, rufous, the apical ones somewhat darkened, second and third long and subequal, the others short; exposed portion of ovipositor somewhat shorter than thorax and abdomen combined, sheath black, densely pilose.

Type.—Cat. No. 18353, U.S.N.M.

Type-locality.—South Acton, Massachusetts.

Host.—*Carpocapsa pomonella*.

Described from eight female specimens; four (the type and paratypes, A, B, and C) from the type-locality reared by E. H. Siegler of the Bureau of Entomology under Quaintance No. 6115 and on the following dates: June 30, July 5 (the type and one other), and July 13, 1913; one (paratype D) from Woodside, Delaware, August 15, 1901, under Delaware Station No. 350; one reared by the author at Vienna, Virginia, under Quaintance No. 7938; one (paratype F) from Smithsburg, Maryland, reared by E. B. Blakeslee of the Bureau of Entomology under Quaintance No. 7466; and one (paratype G) from Rouserville, Pennsylvania, reared by F. L. Simanton of the Bureau of Entomology May 22, 1913, under Quaintance No. 6116.

All of these specimens, except possibly paratype D, the history of which is not known, were reared from the codling moth (*Carpocapsa pomonella*).

Paratypes A and B have the testaceous color on the face reduced to a narrow space surrounding the eyes and the apex of the clypeus. Paratypes D and E differ from the type in having the occiput and thorax, especially on the sides of the latter, reddish-piceous rather than black, all abdominal segments fulvous, the first medially and the apical ones somewhat dusky, and the dark color on the hind legs much reduced, while the general color of the legs is paler. Paratypes F and D differ from the type in having the dark portion of the face

reduced to a V-shaped mark with its base at the base of the clypeus, and the scape and pedicel much lighter; the pronotum in F is reddish-piceous, lighter at the posterior angles. Paratype G has the face and first tergite entirely black and the apex of the abdomen nearly so; the legs are somewhat paler than in the type.

Family ICHNEUMONIDAE.

Genus AENOPLEX Foerster.

AENOPLEX CARPOCAPSAE, new species.

Female.—Length, 7 mm. Black, with second and third tergites and legs rufous, tergites beyond second margined with whitish; clothed throughout with short whitish pubescence; antennae 26-jointed. Face closely, finely punctured; clypeus sparsely punctured at base and apex, smooth and polished medially; vertex and temples sparsely punctured; antennae black with scape beneath, pedicel at apex, and first joint of flagel at base reddish-piceous; mandibles sparsely punctured, reddish at base, tips black; palpi stramineous; pronotum laterally rugulose; mesoscutum rather densely punctured medially, the punctation fading out laterally; weakly striate medially in front of scutellum, notauli distinct anteriorly; meso and meta-pleurae rugulose ventrally, the rugulosity fading out dorsally into sparse punctation; scutellum sparsely punctured, the furrow between it and the mesoscutum without longitudinal raised lines; propodeum sharply areolated, basal median and basal lateral areas smooth and shining, the latter with a few minute punctures; areola slightly rugulose and with a slight median notch behind, other areas rugulose, spiracle round; tegulae and wing bases whitish, a small spot in front of the tegula reddish-piceous; wings suffused with brownish, veins and stigma brown, the latter with a pale spot at base, position of second transverse cubitus indicated by thickenings in the radius and cubitus; legs rufous, their trochanters pale; tips of posterior tibiae and their tarsi, together with the apical joints of all tarsi, infuscated; first tergite black narrowly tipped with reddish-piceous, opaque basally, laterally longitudinally rugulose, smooth and shining apically, with two longitudinal carinae extending about two-thirds of way to apex; second and third tergites dark rufous, opaque basally smooth and shining apically, suture between deeply impressed; remaining tergites black tipped with whitish, smooth; exerted portion of ovipositor one-third length of abdomen; sheath black.

Type.—Cat. No. 18351, U.S.N.M.

Type-locality.—Vienna, Virginia.

Host.—*Carpocapsa pomonella*.

Described from six female specimens, the type and paratypes A to E reared from the larvae of the host species by the writer under Quaintance No. 7897, and one female (paratype F) taken in the same locality October 23, 1913.

The size of the specimens in the type series varies from 5.5 mm. to 7 mm., A being the smallest. Paratype B differs from the type in having the abdomen entirely black, while in F the rufous color embraces the fourth tergite.

AENOPLEX PLESIOTYPUS, new species.

Female.—Length, 5.5 mm. Black, with each of the tergites except the first narrowly margined with white; legs, including coxae rufous, posterior tibiae, and tarsi infuscated. Extremely like the genotype, *Aenoplex betulæcola* Ashmead, from which it differs as follows: antennae only about two-thirds as long as body and 22-jointed; areola two-thirds as wide basally as apically (in *betulaecola* it is less than half as wide basally as apically); petiolar area transversely rugulose (in *betulaecola* the rugulosity is confined to the edges of the area); exerted portion of the ovipositor not more than half as long as abdomen (in *betulaecola* it is distinctly more than half as long).

Type.—Cat. No. 18352, U.S.N.M.

Type-locality.—Alameda, California.

Host.—*Carpocapsa pomonella*.

Described from a single female recorded by A. Koebele under Bureau of Entomology No. 235° as reared August 26, 1887, from a chrysalis of the codling moth.

Genus GLYPTA Gravenhorst.

GLYPTA BREVIS, new species.

Female.—Length, 7 mm., exerted portion of ovipositor 5 mm. Black, mesopleurae laterally, metapleurae, scutellum, middle and hind coxae and all femora rufous; anterior coxae basally, fore and middle tibiae, basal joints of middle and hind trochanters, and front tarsi stramineous; anterior coxae apically, both joints of fore and apical joints of middle and hind trochanters, wing base, tegulae, and spot in front white; hind tibiae white with basal and apical blackish annuli connected below by a longitudinal line of the same color; hind tarsi blackish with the first three joints white basally; middle tarsi rufous with the bases of the first three joints white; antennae dark brownish paler below, scape black; wings hyaline, veins dark brownish; body clothed with short, dense, glistening pubescence; face densely punctured, a prominent rounded tubercle medially, clypeus elevated at base, reddish apically, mandibles

black, frons densely, vertex and cheeks more sparsely punctured; thorax evenly, rather densely punctured throughout, lateral lobes of mesoscutum tinged with reddish; propodeum with the transverse apical carina very prominent and with two arcuately diverging longitudinal carinae, posterior face nearly perpendicular; abdomen short and broad, densely, coarsely punctured, first tergite about as long as broad at apex, its longitudinal carinae flattened and polished, tergites 2-4 each but little longer than half their width, the oblique furrows deeply impressed on 2 and 3; remaining tergites together somewhat shorter than first, tergites 1 and 2 tipped medially with reddish.

Type.—Cat. No. 18356, U.S.N.M.

Described from a single female reared by W. D. Kearfott under his No. 239.

A deformed female was reared at French Creek, West Virginia, from *Carpocapsa pomonella* by Fred E. Brooks under No. 708.

In Cresson's table to the species of the genus¹ this species runs to *rufiscutellaris* Cresson, from which it is at once distinguished by the stouter form, proportionately shorter tergites, and proportionately longer ovipositor.

Genus NOTOPYGUS, Holmgren.

Table to the North American species.

Mostly uniform ferruginous.....*cultus* Cresson.

Head and thorax black or mostly black.

Abdomen mostly rufous; face black; fore and middle coxae rufous.*excavatus* Davis.

Abdomen mostly black; face yellow; all coxae black....*virginiensis*, new species.

NOTOPYGUS VIRGINIENSIS, new species.

Female.—Length, 13 mm. Head black with face, clypeus, palpi, and mandibles except at tip yellow; rather densely clothed with brownish hair which is very long on clypeus and mandibles; temples and occiput finely, face, clypeus, and mandibles rather coarsely punctured; antennae (broken) black, first flagellar joint about three times as long as thick, others gradually decreasing in length until toward the tip they are quadrate; thorax black, tegulae yellow, small spots in front and below brownish; densely punctured except for smooth spot on mesopleura; propodeum somewhat more coarsely punctured, especially on lateral areas; clothed throughout with dense, short, brownish pubescence; coxae and femora black, the latter yellow apically and basally, except that the posterior pair lack the yellow basally; fore and middle trochanters yellow with a brown spot behind, hind trochanters blackish except apically and ventrally where they are yellowish; all tibiae and tarsi yellow; wings dusky,

¹ Trans. Amer. Ent. Soc., vol. 3, 1870, pp. 151-2.

veins blackish except spot at base of stigma and costa, which are brownish-yellow; wing base yellow, areolet subtriangular and petiolate; abdomen black above with the terminal tergites largely brownish-yellow and a broad band of the same color on each of the first two intersegmental sutures and tergites 3-5 narrowly tipped with this color; sternites blackish except for narrow brownish-yellow margins; hypopygium prominent and broadly yellowish at apex; abdomen clothed throughout like thorax; first tergite elevated in the middle with two parallel longitudinal carinae reaching nearly to the apex and inclosing a deep furrow, another furrow on each side extending from spiracle to apex, a deep fovea below each spiracle, irregularly transversely rugulose on sides of petiole and in the furrow, coarsely and densely punctured apically and laterally beyond spiracles; second tergite coarsely, densely punctured with the carinae extending hardly halfway to the apex; remaining tergites, except base of third, which is rather densely punctate, smooth with fine, sparse punctures; ovipositor directed upward, pale brown, sheath yellowish.

Type.—Cat. No. 18355, U.S.N.M.

Type locality.—Vienna, Virginia.

Described from a single female taken by the writer November 2, 1913.

Genus IDECHTHIS (Foerster) Ashmead.

IDECHTHIS NIGRICOXALIS, new species.

Female.—Length, 10 mm. Related to *erythropus* Ashmead, from which it differs as follows: Scape and pedicel beneath and mandibles dark testaceous instead of pale yellow; pronotum laterally shining with strong longitudinal rugæ (opaque in *erythropus*); tegulae dark testaceous rather than whitish; all coxae and hind legs throughout black, front and middle femora and trochanters and middle tibiae infuscated; basal lateral areas of propodeum with a few large punctures, petiolar areas more strongly transversely rugose.

Male.—Length, 8 mm. Differs from female principally in having the posterior legs beyond the coxae dark testaceous, in largely lacking the infuscation on the front and middle legs, and in lacking the punctures on the basal lateral areas of the propodeum.

Type.—Cat. No. 18354, U.S.N.M.

Type-locality.—Youngstown, New York.

Host.—*Euzophera semifuneralis*.

Described from two females and two males as follows: The type female bears the further data Quaintance No. 574, 7.31.05, F. Johnson, collector; and the allotype Quaintance No. 7966, Vienna, Virginia, VII.11.13, reared by R. A. Cushman (host unknown); a female (paratype B) which agrees with the allotype in the color of the legs

bears the data Quaintance No. 407 (this number referring to a note which shows that the host was the larva of *E. semifuneralis*), Fort Valley, Georgia, 6.8.05, J. H. Beattie, collector; and a male (paratype A) which is somewhat smaller than the allotype, labeled Quaintance No. 5626, Lakeside, Ohio, 5.22.08, on peach, H. F. Wilson, collector.

With the exceptions noted this species is very similar to *erythropus* and may possibly be an eastern form of that species, especially since some specimens of *erythropus* have the four anterior coxae more or less infuscated basally.

Additional specimens from Youngstown, New York, were reared from *Euzophora semifuneralis* and one from Fort Valley, Georgia, from *Sanninoidea exitiosa*.

CONTRIBUTIONS TO THE KNOWLEDGE OF THE MAMMALS OF THE PLEISTOCENE OF NORTH AMERICA.

By OLIVER P. HAY,

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INTRODUCTION.

The results detailed on the following pages have been obtained in the course of the writer's investigations on the Vertebrata of the Pleistocene epoch in North America. These results include descriptions of two extinct horses, one new extinct bison, one new and one already-described musk ox, measurements of certain limb bones of fossil horses, and discussion of the meaning of the variations observed. Also there have been secured measurements from many skulls of various equids, as of Przevalsky's horse, of a number of fossil horses, of many domestic horses, of three species of zebras, of the domestic ass, of the chigetai (*Equus hemionus*), and of the kiang (*E. kiang*). A considerable number of these measurements have been quoted from other authors, but many have been made by the writer on skulls which belong to the United States National Museum and to the American Museum of Natural History, and on a fossil skull in the University of Kansas. From these measurements certain indices in use in equine craniometry have been computed. From these measurements and indices an attempt has been made to determine to what extent the various unmixed and wild species which are considered deviate from an average condition; likewise, to ascertain the value of some of the measurements and indices which have been employed in the study of domestic horses; and, finally, an endeavor has been made to throw some light on the elements which have contributed to the formation of that assemblage of horses which bears the name *Equus caballus*.

The writer acknowledges his obligations to the institutions which have kindly and freely granted him access to their materials.

1. DESCRIPTIONS OF A BISON AND TWO MUSK OXEN.

BISON SYLVESTRIS, new species.

Diagnoses.—A bison of the late Pleistocene, having the horn cores feeble, even in case the type was a female, and apparently directed outward in a plane at right angles with the axis of the skull. Ptery-

goid processes relatively short. Foramen ovale confluent with the foramen lacerum medius. Forehead in front of horn cores narrower than the skull across the zygomatic arches.

Type.—Some portions of the rear of the skull and a part of the right ramus of the lower jaw containing the last premolar and the anterior two molars. Found in Huron County, Ohio.

The writer received for examination, on May 2, 1914, from Hon. C. H. Gallup, of Norwalk, Ohio, a small package of fossil bones which had belonged to some bovine animal. These had been found in a tamarack swamp at some place not yet exactly ascertained in Huron County, Ohio. In the same swamp had been discovered bones of a megalonyx, and in the course of a search for other parts of the skeleton of this animal those of the bovine had been met with. A piece of soil inclosing the bones was sent with them, and it is found to be composed of a mixture of vegetable matter and fine mineral materials. The bones consist of a fragment of the right side of the skull bearing the pedestal of the horn core, another fragment showing the axial region, the left glenoid fossa, etc., and a part of the right ramus of the lower jaw, with some teeth. A study of the specimen shows that they belonged to a hitherto undescribed species of the genus *Bison*. The writer proposes to give it the name *Bison sylvestris*.

The piece of skull (pl. 30, fig. 1) which presents the pedestal of the right horn core is 91 mm. in its greatest dimension. It consists of a triangular piece of the frontal, a portion of the parietal forming the side wall of the temporal fossa, and a part of the occiput. The interior of this mass is full of air cells, but these hardly extended beyond the base of the pedestal. The pedestal itself is placed well in front of the occipital crest, so that we may be sure that the animal was not a species of *Bos*.

Through some means the pedestal has been broken or gnawed or eroded off so as to be wedge shaped at the extremity. No part of the horn-core itself appears. The pedestal has a diameter of 25 mm. only; hence the horn-core and the horn were evidently very small. It seems pretty certain that the animal was a female. The horn-core was probably directed somewhat upward, as well as outward. It appears also to have started out at right angles, or nearly so, with the median plane of the skull, as in *Bison antiquus*. In other species of American bison, recent and fossil, the horn-cores are directed outward and somewhat backward. The parietal of the specimen under consideration runs forward from the rear of the temporal fossa a distance of 66mm., nearly the same as in the skull of the jersey cow with which it is compared. The suture between the frontal and the parietal extends forward well in front of the pedestal of the horn-core, then turns downward so as to approach rather rapidly the parieto-

squamosal suture. This course is quite different from that followed in the existing American bison. In this bison the suture continues forward to opposite the middle of the pedestal or hardly so far, and then descends toward the parieto-squamosal suture; and the point where the suture turns downward seems not to be affected by the size of the horn-core. The anterior end of the parietal in the fossa of the fossil bison is narrow and somewhat prolonged. The horizontal part of the parieto-frontal suture has the same length as in the jersey cow; but, since in the latter the horn is situated farther backward, the point where the suture turns downward is much farther in front of the horn than in the fossil bison. It is noted, too, that in the latter the roof of the temporal fossa extends out on the base of the pedestal, but it does not do so in the jersey skull.

That part of the parietal of the fossil which enters into the occiput is 23 mm. wide and rather rough, and it appears to have formed a part of the occipital crest.

The larger fragment (pl. 30, fig. 2) presents a part of the base of the skull, including the left occipital condyle and a part of the right; most of the basioccipital and the basisphenoid; that part of the left squamosal which enters into the glenoid fossa and the zygomatic arch; and a part of the auditory apparatus. For our understanding of the skull it would have been better if the two fragments had belonged to the same side, for both reach the suture between the parietal and the squamosal, in the temporal fossa.

The distance from the median point on the lower lip of the foramen magnum to the front of the basisphenoid is 85 mm., as in the jersey cow. In the skull of a cow buffalo (No. 15690, National Museum), whose basilar length is 423 mm. and whose upper tooth line is 148 mm. and whose width of skull at the zygomatic arches is 205 mm., the distance forward to the front of the basisphenoid is 98 mm. The width across the occipital condyles can not be exactly determined, but it was about 96 mm.; that of the jersey being 93 mm.; that of the small buffalo cow just mentioned, 110 mm. The width across the tuberosities on the basioccipital was close to 56 mm.; in the jersey 45 mm.; in a large bison 62 mm.; in another bison 57 mm. In the jersey cow and in the American bison there are tuberosities on the basisphenoid which sometimes are hardly more than rough surfaces, but which may form considerable processes. In the fossil under consideration, these form two platelike processes of bone. These are about 25 mm. long at their bases, extend downward about 12 mm. from the lower surface of the basisphenoid, and are 4 mm. or 5 mm. thick. They diverge from each other and leave a channel between them into which one may lay one's little finger. When enlarged, in the bison, these tuberosities are quite thick and are probably never so high. How much variation in this respect there was in the new species one can not yet know.

The pterygoid processes of the alisphenoid have the appearance of having been quite different from those of both the existing bison and the jersey cow. In both the latter animals these processes extend far downward and forward from their bases, 45 mm. in the jersey, 60 mm. in the small cow buffalo mentioned above. In this latter specimen each process has, very close to its distal end, a width of 21 mm. In our fossil species these processes appear to have been only about 20 mm. long, in this respect resembling some of the antelopes; and they come to a point in front. It is possible that a thin edge has disappeared, but there is no evidence of it. On the inner face of the front edge there appears to be a sutural surface for union with the palatine and the pterygoid. This front edge slopes directly downward and meets the descending hinder border, so that the process is triangular. The base of the process is about 18 mm. long. The hinder border is acute; while in both the jersey and the American bison it is thick and obtuse.

The region at the inner extremity of the petrous bone and in front of it appears to have been extremely different from that usually seen in artiodactyls. In the jersey and the existing bison and nearly all other artiodactyls the foramen ovale is inclosed by the alisphenoid. While the bar of the bone on the outer border of the foramen in the bison is narrow, it is thick, 5 mm. or more, on the inside nearly 10 mm. In the jersey, too, the bone is thick all around the opening. In both these animals the foramen lacerum medius is cut off from the ovale by a wide stretch of bone belonging to the alisphenoid. On the other hand, in the fossil here described the region in front of the petrosal is widely open; and, apparently, the two foramina mentioned formed one. The alisphenoid certainly appears not to have sent a prong of bone around the outer side of the foramen ovale. The bone forming the front boundary of this foramen comes down to a thin acute edge, and when it is followed around to meet the squamosal the alisphenoid appears to have stopped there. The opening which represents the two foramina mentioned extends backward 27 mm. to the bone. Backward it widens to nearly 25 mm. The hinder part of this gap was, of course, occupied by a part of the bulla. It is possible that the outer edge of the basisphenoid extended into the opening and restricted it somewhat, but there is little or no evidence of it. It is more likely that the inner border of the squamosal extended inward farther and narrowed the foramen somewhat. In the antelope *Taurotragus* the foramen ovale is sometimes large and the alisphenoid bar on its outer border is interrupted, but always this foramen is closed behind by a union of the alisphenoid with the squamosal.

After renewed examinations of this region in the fossil and comparisons of it with specimens of *Bison bison* the author fails to find any way of reconciling the differences.

The bar of bone between the foramen lacerum medius and the foramen lacerum anterius is thin, 3 mm., and in front has an acute edge. In the other two bovines here considered the bone is considerably thicker (from 7 mm. to 11 mm. in the bison) and the front edge is obtuse.

The paroccipital process is broken off, as is also the bulla.

The squamosal of our fossil, seen from the outside, presents some features and relations of interest. In both the living bison and in the jersey that part of the squamosal which enters into the temporal fossa rises perpendicularly or in the jersey even slopes inward to join the parietal. In the fossil bison the bone as it ascends turns outward, so as to overhang very considerably. Just above the root of the zygomatic process of the squamosal, at the rear of a considerable excavation, are two considerable venous foramina. These are present in the jersey skull also, and in many skulls of *Bison bison*, but their presence, number, size, and positions are subject to great variations.

The articular surfaces for the lower jaw are placed on a higher level with respect to the basisphenoid than in *Bison bison*. A line drawn from the lowest part of one of these surfaces to that of the other passes considerably above the basisphenoid. In the existing bisons examined such a line passes through the body of the basisphenoid. The same statement may be made regarding the jersey cow.

In the fossil bison here described the exoccipital of the left side is preserved nearly to the midline above the occipital foramen, where it met the one of the opposite side. This permits the measurement of the foramen. The distance from the front of the lower border of the foramen to the middle of the upper border is 40 mm.; in the jersey it is 38 mm.; in the skull of the small cow buffalo this measurement is 40 mm., as well as in a much larger male individual. In the fossil the greatest distance across the foramen magnum, just in front of the hinder borders of the condyles, was close to 50 mm.; in the jersey it is 45 mm.; in the skull of a large male bison, close to 50 mm.; in the skull of another large male bison, 45 mm.; in the cow buffalo mentioned, 44 mm. It will be seen that in the fossil the opening is absolutely larger than in the other animals used for comparison, although they belong to specimens of evidently greater size.

The cavity found just outside of each occipital condyle and into the front of which opens the condylar foramen is much shallower than in the great majority of specimens of *Bison bison*; but inasmuch as variations are observed in the latter one can not count with certainty on this shallowness as a specific character. Careful measurements indicate that the inner walls of the temporal fossae approached each other more rapidly from the rear to the front in the fossil than

in the existing bisons, and that consequently the brain cavity of the former was actually and relatively narrower in front than in the latter. As exactly as can be determined the width of the brain-case of *B. sylvestris*, taken in the temporal fossa, over the auditory meatus, was at least 110 mm.; at the front of the glenoid articulation, not more than 90 mm. In the cow bison, already several times mentioned, the width at the rear position is 120 mm.; at the anterior position, 110 mm. In the jersey cow referred to above the measurements are respectively 98 mm. and 82 mm. Therefore the brain-case of *B. sylvestris* was narrowed forward almost exactly as in the jersey cow and more rapidly than in the existing bisons.

As nearly as the width of the skull can be determined it measured 180 mm. across the zygomatic arches at the glenoid fossae. In the case of the cow bison this measurement is 200 mm.; in the jersey cow, 166 mm. From the rear of one temporal fossa to that of the other is about 140 mm.

In the existing bison of our country the skull, at the narrowest place between the horns and the orbits, is at least as wide as it is across the zygomatic arches, often much wider. In the jersey cow the least width across the forehead is considerably less than across the zygomatic arches; and this appears to have been the condition in the extinct species here described. As just mentioned, the width across the glenoid fossae is 180 mm.; the least width across the forehead seems to have been close to 140 mm. The forehead naturally presented an appearance quite different from that of *Bison bison*.

So far as can be determined from the materials at hand, the parieto-occipital suture on the upper surface of the skull was pushed backward somewhat farther than in the American bison. In front of the pedestal of the horn-core there is a sharp crest which separated the temporal fossa from the forehead. In the existing bison this region is thick and obtuse. It is more acute in the jersey skull, but not so acute as in the fossil.

An apparent difference between the existing species of bison and the fossil here described is found in the occipital condyles. In the fossil the condyle is narrow near its lower anterior end; the least width from its border at the foramen magnum to that near the excavation containing the condylar foramen is about 21 mm.; in the specimens of *Bison bison* examined the width varies from 26 mm. to 33 mm. Naturally other specimens of *B. sylvestris* might abolish this difference.

The lower jaw is represented by the greater part of the horizontal ramus of the right side. Only the hindermost part of the symphysis is left, the bone being broken off just at the front of the mental foramen. On the outer side the bone as preserved continues back-

ward above and below to points a short distance behind the socket of the hindermost molar; on the inner side to a line descending from a point just behind the second true molar. In this jaw are retained the last premolar and the first and second molars. The sockets of the second and third premolars and the last molar are present.

It is, of course, impossible to determine what was the length of the jaw and the length of its symphysis. The following measurements are obtained and compared with corresponding measurements of the jaw of the jersey cow already mentioned and of two female specimens of *Bison bison* (No. 14099, Amer. Mus., and No. 49680, Nat. Mus.). In the case of the jersey the front milk molar must take the place of the second premolar in the measurements.

Measurements of lower jaws in millimeters.

	<i>Bison sylvestris.</i>	<i>B. bison,</i> 49680, U.S.N.M.	<i>B. bison,</i> 14099, Amer. Mus.	Jersey cow.
Distance from rear of symphysis to front of socket of the second premolar.....	62	70	56	50
Distance from rear of symphysis to rear of second molar.....	160	180	150	154
Distance from rear of mental foramen to rear of second molar.....	159	171	-----	158
Height of jaw just behind the symphysis.....	23	36	24	26
Thickness of jaw just behind the symphysis.....	13	15	14	14.5
Height of jaw at front of socket of premolar ₂	29	41	31	31
Thickness of jaw at front of socket of premolar ₂	16	16.5	17	16
Height of jaw at rear of second molar.....	53	61	54	58
Thickness of jaw at rear of second molar.....	28	27	28	24

The following measurements of the lower teeth have been secured from the type-specimen of *Bison sylvestris*; from No. 14099, a female bison in the American Museum; an old domestic cow, No. 92, in the collection of Mr. S. H. Chubb, of the American Museum; and the already oft-referred-to jersey cow in the United States National Museum. The teeth of No. 92 had been more worn down than in the other specimens, and this fact will account for the reduced length of the grinding faces.

Measurements of lower teeth in millimeters.

	<i>Bison sylvestris.</i>	<i>B. bison,</i> No. 14099.	Old cow, No. 92.	Jersey cow.
Distance from front of socket of pm ₂ to rear of socket of m ₂	104	95	93	104
Distance from front of pm ₄ to rear of m ₂	71	66	85	72
Premolar ₄ , height.....	19	22	16	-----
Premolar ₄ , length.....	21	20	18	-----
Premolar ₄ , width.....	12	11.3	15	-----
Molar ₁ , height.....	20	25	15	30
Molar ₁ , length.....	22	23	22	24
Molar ₁ , width.....	13.5	14.5	13.5	13
Molar ₂ , height.....	34	30	23	46
Molar ₂ , length.....	26	24	23	26
Molar ₂ , width.....	17	15	14	16

The second and third premolars of the jersey had not been cut, and the first two measurements of the third column start with the front of the corresponding milk molar. In the case of the second molar of *Bison bison* (No. 14099, Amer. Mus. Nat. Hist.) the height and the greatest width can not be determined without cutting into the bone. The heights of the teeth are given in order to indicate approximately the amount of wear. As the teeth are worn down the fore-and-aft length of the crown diminishes, while the width increases. It is to be noted that the teeth of the jersey cow are less worn down than either of the others. Were we to measure the length of the crown of the jersey at the same level as those of the

fossil, the former would show a length at least a millimeter less than they do. Where possible, the width of the teeth as given is that at the base, where greatest.

It is necessary now to compare the teeth of the fossil with those of the jersey and of the bison. The teeth of the fossil (pl. 30, figs. 3, 4; text-fig. 1) are somewhat injured, but not to a serious extent. A little enamel is split off from the outer and the inner styles at the rear of the fourth premolars. A part of the hinder inner column (entoconid) is broken away, also a very little of the summit of the anterior outer column (protoconid) of the second molars; likewise a sliver from the hinder inner style of the same tooth. All of the cement has been dissolved off the teeth and the dentine is considerably decayed. The enamel of the teeth is apparently more wrinkled than in most specimens of the two species with which it is here compared.

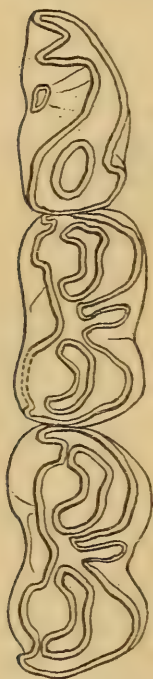


FIG. 1.—LOWER MOLARS OF *BISON SYLVESTIS*. $\times 1$.

In the fourth premolar the excavation, or infold, in the outer face, in front of the hinder style, is much narrower and more sharply defined than in the specimens of *B. bison* examined. In the existing bison there are usually two infoldings of the enamel of the hinder half of the inner face of the tooth and in front of these a narrower excavation or channel. Sometimes the hinder infold is divided so as to cut off a circular pit in the hinder part of the tooth. The anterior infold referred to is usually directed inward and often inward and backward. In the fourth premolar of *B. sylvestris* there is a circular pit in the hinder part of the tooth, as seen in the figure. The enamel of the inner face is directed forward and outward to near the point of the tooth, then abruptly inward, then again outward and forward, and finally again inward. There is thus formed a great excavation in the inner face of the tooth, and in front of

this two folds of the enamel. At the bottom of the excavation there arose a slender accessory column, but this is broken off. This tooth in *B. bison* presents a considerable amount of variation, and it is possible that it sometimes takes the form seen here in *B. sylvestris*.

The two molars resemble closely the corresponding teeth of *B. bison*. The inner columns are somewhat more sharply separated by shallow folds of the enamel from the body of the tooth, but probably similar conditions might now and then be found in specimens of *B. bison*. One can not yet say that there is any character in the teeth of *B. sylvestris* by which it may be distinguished with certainty from *B. bison*; but it is also true that the teeth of all the bisons are much alike and all resemble closely those of the domestic ox.

It will be seen that the animal whose scanty remains were secured in Ohio does not belong to the genus *Bos*; it is equally evident that it did not belong to any species of bison hitherto found in this country. To judge from the parts known, the type-specimen had the size of a small domestic cow; but it is probable that the males were considerably larger. The skull seems to have been somewhat wider, but to have had the same length. The horns were feeble, but doubtless larger in the males. As to the habits of this bison, we can infer little. There can be no doubt that, like the megalonyx which found a grave in the same spot, it lived after the passing away of the Wisconsin ice sheet. The presence of the megalonyx seems to imply the existence of a climate warmer than that of to-day. At the same time in all probability there lived in that region mastodons, elephants, peccaries, and the giant beaver, all, like the bison, now gone. Doubtless then, as now, Ohio was heavily forested. In these forests, possibly haunting the swamps, lived the animal that is to be known as *Bison sylvestris*.

BOÖTHERIUM NIVICOLENS, new species.

Diagnosis.—A Pleistocene species of *Boötherium* which has the exostoses of the horn-cores slightly encroaching on the forehead; horn cores directed strongly outward, only slightly downward and forward.

Type.—Both horn-cores with the frontals. Found at Elephant Point, Alaska.

An incomplete skull of a species of musk ox, No. 2324 in the United States National Museum, was collected in 1880 on the shores of Eschscholtz Bay, Alaska, probably at Elephant Point, by Capt. C. L. Hooper, commanding U. S. revenue steamer *Corwin*. The specimen has hitherto been regarded as the skull of a female of *Ovibos moschatus*, but a close examination shows that this is an error.

In his report of the cruise of the steamer *Corwin*, published in 1881, on page 24, Hooper wrote as follows in speaking of his visit to Elephant Point:

I searched the face of the cliff at Elephant Point for fossil remains, but found none either in the ice or in the soil above it. I was more fortunate, however, on the beach below after the tide fell. There I found a large number of mammoth bones and tusks and some smaller bones belonging, probably, to the "aurock" and musk ox.

Although the skull here described was not specifically mentioned, it is probable that it was included in among the "smaller bones."

The specimen (pl. 31, fig. 1) consists of the horn-cores practically complete and the parietal and frontal bones which bore them. The supraoccipital region is missing, also the whole of the floor of the brain case and the bones of the jaws. Of the orbits, only the upper and hinder part of the rim of the left one is preserved. The frontals do not extend as far forward as the notch for the hinder ends of the nasals. Many important measurements are therefore not to be obtained. The following are given:

Measurements of the skull of Boötherium nivicolens in millimeters.

Width at notch between orbits and horn-cores at the lower border of the latter	126
Width at the rear of the orbits, estimated.....	185
Least distance between exostoses of horn-cores on forehead.....	100
Distance between exostoses at rear of horn-cores.....	140
Transverse diameter of brain case.....	90
Thickness of parietal bone at about its center.....	46
Fore and aft diameter of base of horn-core.....	63
Vertical diameter of base of horn-core.....	58
Circumference of base of horn-core.....	200
Length of horn-core on hinder curve.....	205
Length of chord of anterior curve of horn-core.....	165
Distance between the extremities of the horn-cores.....	466

The rear of the upper surface of the specimen extends backward a distance of 75 mm. behind the line which joins the hinder borders of the bases of the horn-cores, and it must have reached the occipital crest. The hinder end of the skull, at the level of the parieto-squamosal suture must have had a width of close to 105 mm. In getting the width of the skull between the orbits and the base of the horn-cores in *Ovibos* one measures at the middle of the height of the horn-core or even higher. In the specimen of *B. nivicolens* it is necessary to descend to the lowest point of the base of the core, for from this point upward the skull narrows.

The base of the horn-core is nearly circular in section, the upper surface being only slightly flattened. At about the middle of the length the horn-core is still flattened, the fore-and-aft diameter being

48 mm., the vertical 41 mm. The horn-cores descend less as they pass outward than they do in either *B. bombifrons* or *B. sargenti*. When a cord is stretched from the tip of one horn-core to that of the other it passes but little in front of the rear of the orbit and above what would evidently have been the lower border of this. The cord is on a level with the roof of the brain cavity.

The horn-cores may be said to stand on short pedicels and to have a burr, as in the bisons. On the upper surface, however, the exostosis has just begun to spread on the forehead and has hidden the pedicel. The condition is intermediate between that seen in *B. bombifrons*, with an evident pedicel, and that of *B. sargenti*, in which the exostosis has advanced well on the forehead.

The parietal bone is a mass which contains numerous small cavities, like those of a fine sponge. The frontals, 60 mm. thick at the mid-line, are occupied by large air cells, some of which open into the bases of the horn-cores. The plane of that part of the upper surface of the skull which is behind the horn-cores makes an angle of about 47° with the plane of the anterior part. The angle in *B. sargenti* appears to be about the same as in *B. nivicolens*. Considering all the facts, the writer is compelled to place both these species just mentioned in the genus *Boötherium*.

Because of the direction taken by the horns, more outward and less downward, *B. nivicolens* is evidently distinct from both the other species. By its long slender horn-cores, carried far in advance of the orbits, *B. sargenti* is distinguished from *B. bombifrons*.

BOÖTHERIUM SARGENTI Gidley.

This species was described by J. W. Gidley in 1908.¹ The describer's figures present views of the partial skull as seen from in front, from the left side, and from above. His description is brief, and no measurements were presented. Neither are the relative sizes of the figures given; but the statement was made that the size was about two-thirds that of *Ovibus moschatus* and somewhat greater than that of *Boötherium bombifrons*. Wishing to study the specimen at first hand the present writer, in January of the year 1914, visited the Kent Scientific Museum at Grand Rapids, Michigan, where the specimen is deposited. Opportunity to examine this and other Pleistocene materials was freely given by the director of the museum, Mr. H. E. Sargent.

The specimen was found, as stated in the original description, in the Moorland swamp, on the farm of Mr. Charles McKay, near Grand Rapids, Michigan. Mr. McKay has kindly informed the writer that the exact locality is in the northwest quarter of the northeast quarter of section 16, in township 10 north, range 14 west.

¹ Proc. U. S. Nat. Mus., vol. 34, p. 683, pl. 79.

This is very nearly 25 miles from Grand Rapids in a straight line in a direction a little north of northwest. The depth at which the skull was found was about 2 or 3 feet only. Mr. Sargent informed the writer that the skull lay beneath the pelvis of a mastodon, the nearly complete skeleton of which is mounted in the Kent Scientific Museum.

The following measurements were secured from the skull. Inasmuch as it is much damaged in its axial portions many desirable measurements, especially the basilar length, could not be obtained. A figure is shown (pl. 31, fig. 2) which gives a view of the skull from the left side. Mr. Gidley published a figure from the same photograph.

Measurements of skull of Boötherium sargenti in millimeters.

Distance from the rear of one orbit to that of the other.....	190
Width of skull between the orbits and the horn-cores, on a level with the lower surface of the latter.....	128
Width of space between the horn-cores at their rear.....	147
Width of space between the horn-cores, on the face, least.....	62
Fore-and-aft diameter of the orbit.....	65±
Length of a horn-core along the hinder curve.....	352
Circumference of the base of a horn-core.....	242
Fore-and-aft diameter of a horn-core.....	80
Diameter of horn-core at right angles to preceding.....	68
Distance between tips of horn-cores, direct.....	505
Width of brain cavity.....	88

The distance from the occipital crest to the notch for the rear end of the nasals was close to 210 mm.; the crest itself is missing. In *Boötherium bombifrons* this distance is 240 mm.

The horn-cores (pl. 31, fig. 2) are directed strongly outward and forward and somewhat downward. The distal extremity of each reaches a point 55 mm. in front of the rear of the nasals and 95 mm. below the upper surface of these bones. At the base the horn-core is subcircular in section; but the upper face is considerably flattened. However, at a short distance from the base the section becomes nearly circular. The surfaces of the cores are strongly grooved. A fragment of each of the nasals about 70 mm. long is present and to each is attached a fragment of the maxilla.

The profile of this skull is not straight. It is convex in the region of the horn-cores and concave between the orbits.

Dr. J. A. Allen¹ has expressed the opinion that this skull represents merely the female of *Symbos cavifrons* and that it shares no essential features with *Boötherium bombifrons*. He says that the horn-cores are attached to the skull as in the female of *Oviðos*, with about the same relative area of exostosis extending from the base over the

¹ Mem. Amer. Mus. Nat. Hist., vol. 1, pp. 214, 215.

lateral third or more of the frontals and not, as in *Boötherium*, supported on a pedicel and terminating in a burr as in *Bison*.

That the type of *Boötherium sargenti* is the female of *Symbos cavifrons* the present writer does not, for various reasons, at all believe. He has examined about 25 skulls which belong to *Symbos cavifrons*. In all of these the exostoses of the horn-core meet across the forehead. If the Grand Rapids skull is the female of *S. cavifrons*, it is very remarkable that only one female should be discovered among 25 specimens. Among the skulls of *S. cavifrons* there is a good deal of variation in the size of the cores. It seems very probable that those specimens which have the more feebly developed cores are the females. Inasmuch as in the males of *Symbos* the exostoses are more strongly developed than in the males of *Ovibos*, one might expect them to be more strongly developed in the females of *Symbos* than they are in those of *Ovibos*. These exostoses having reached the limit in the males, had probably reached that limit in the females likewise. The horn-cores of *B. sargenti* are, relatively to the size of the animal, longer than they are in *S. cavifrons*; and, besides, they are directed more strongly outward and farther in front of the orbit. Notwithstanding the immense development of the horn-cores of the males of *Symbos cavifrons*, there is no such elevation of the region behind the orbits as we see in the case of *B. sargenti*.

On page 210 of his work on musk-oxen, Allen gives as one of the characteristics features of the genus *Boötherium* the abrupt downward slope of the dorsal outline of the skull posterior to the horn-cores. The type skull of *B. sargenti* has a slope of the same region which lacks but a few degrees of being equal to that found in *Boötherium*. The other characters mentioned by Allen as distinguishing *Boötherium*, the form of the basisphenoid and the presence or absence of lachrymal fossae can not be determined in the skull of *B. sargenti*. In size the animal was somewhat below *B. bombifrons*. As to the fact that the bases of the horn-cores had begun to spread across the forehead, it may be said that it becomes simply a question whether we shall put the specimen in the genus *Boötherium* or establish a new one for it. Inasmuch as *Boötherium nivicolens* is intermediate, with respect to the extension of the exostoses, between *Boötherium bombifrons* and *B. sargenti*, the writer prefers to retain the latter in *Boötherium*.

2. DESCRIPTIONS OF THE NEW HORSES.

EQUUS HATCHERI, new species.

Diagnosis.—A large Pleistocene horse, which resembles closely the larger varieties of *Equus caballus*, but which has a broader skull, a heavier lower jaw, and certain differences in the teeth.

Type.—A nearly complete skull and lower jaw. Found near Hay Springs, Nebraska.

In the United States National Museum is a nearly complete skull which belongs to a species of *Equus*, which was found in 1886 in the region south of Hay Springs, Nebraska, and which has the number 7868. The exact locality is given on page 568, where is indicated the place at which certain limb bones of horses had been discovered. All these remains were collected by Mr. Hatcher and his party.

Certain fragments of bone are missing from the skull, as seen from above and from the sides; other parts are gone on each side of the base of the skull and from the palate. The illustrations (pls. 32, 33), prepared from photographs, indicate the positions of the missing parts. Apparently nothing is missing that is necessary to an understanding of the structure of the skull. The teeth are all present in both the upper and the lower jaws; the incisor teeth are worn down nearly to the bottom of the cups, but the premolars and molars show less wear. The second molar has still a height of 65 mm. Inasmuch as large canine teeth above and below are present, it is concluded that the animal was a male.

The following measurements have been secured from the skull. In order to permit comparisons to be made there are presented likewise, in parallel columns, corresponding measurements obtained from the skull of *Equus niobrarensis*, found in the same quarry and described in 1913,¹ and from a skull of domestic horse (No. 843, Nat. Museum). The dimensions within parentheses are taken from the lower jaw of a slightly smaller and older horse (No. 174968 Nat. Museum).

Measurements of skulls in millimeters.

Distances.	<i>E. hatcheri.</i>	<i>E. niobrarensis.</i>	<i>E. caballus.</i>
From middle of incisive border to front of foramen magnum.....	552	530	550
From middle of incisive border to front of posterior nares.....	300	290	300
From middle of incisive border to rear of notch between nasal and premaxilla.....	206	200	196
From middle of incisive border to rear of occipital crest.....	615	582	602
From middle of incisive border to front of pm ₂	152	137	143
From middle of incisive border to front of orbit.....	364	340	362
From middle of incisive border to rear of orbit.....	427	420	438
Width across mastoid processes.....	114	110	129
Width across hinder nares.....	56	47	55
Width across articulations for lower jaw.....	230	217	213
Width from outside to outside of last molars.....	130	123	127
Width from outside to outside of outer incisors.....	76	78	75
Distance between fronts of orbits.....	176	158	153
Distance between rears of orbits.....	236	240	220
From middle of occipital crest to rear of orbit.....	228	218	228
Width of skull on maxillary ridge at maxillo-malar suture.....	210	187	188
Width of palate at last molars.....	82	70	77
Width of palate at pm ₂	48	50	53
Distance across premaxillae at middle of nasal opening.....	72	75	67
Least width of palate between i ³ and pm ₂	40	45	45
Distance between i ³ and pm ₂	115	105	110
Diameter of orbit, fore and aft.....	68	84	70
From front of lower jaw to rear of ascending ramus.....	460	467	(472)
Length of symphysis of lower jaw.....	90	90	(97)
Height of jaw at front of m ₁	100	96	(82)
Rear of i ₃ to front of pm ₂	102	93	(113)

¹ Proc. U. S. Nat. Mus., vol. 44, p. 576, pl. 69, figs. 3-4; pl. 70; pl. 71, figs. 1, 2; text figs. 19-23.

On comparing the above measurements it is seen that the horse here called *Equus hatcheri* had a longer skull than that of *E. niobrarensis*, one of the same length as that of the larger domestic horses. In Nehring's list of 60 specimens of equines measured there are only 7 which had longer skulls than that here described. It belongs, then, among the very large horses.

The width of the skull at the rear of the orbits is 236 mm. This does not appear to have been exaggerated in repairing the specimen. This width is equal to 42.6 per cent of the basilar length, so that this quantity represents the cephalic index. Nehring obtains this index in the reverse way, following which the cephalic index would be 234.9. This horse would then fall into Nehring's group of broad-faced horses, but, in Tscherski's classification, in the group with faces of medium breadth. As will be seen by referring to a table on a more advanced page, the skull of *E. hatcheri* has nearly the same cephalic index as the Przevalsky horse. The latter is, however, a smaller animal. *E. niobrarensis*, as indicated by the type, had a relatively broader skull, the index being 45.3; or, after Nehring's method, 220.8. It belongs, then, among those with the very broadest faces, resembling in this respect the kiang. Whether or not additional specimens of both *E. hatcheri* and *E. niobrarensis* would sustain our conclusions only future investigations will decide.

The cranial length is 195 mm.; that is, the distance from the middle of the occipital crest to the middle of the line joining the rear of the orbits. The cranio-cephalic index is determined, then, to be equal to 35.3, being, therefore, more nearly equal to that of the broad-faced domestic horses than to that of the narrow-faced ones. In *E. niobrarensis* the index is 34.3.

The facial length (distance from incisive border to the middle of the line joining the rear of the orbits) is 413 mm. This multiplied by 100 and divided by the basilar length gives as the facio-cephalic index 74.8. That of the type of *E. niobrarensis* has been determined to be 75.3. The horse which is here described is therefore relatively short-faced, as well as broad-faced.

The length of the nose is relatively greater than in the domestic horse No. 843, but nearly the same as in the type of *E. niobrarensis*.

There appears to be a considerable difference between the horse here described and the type of *E. niobrarensis* in the width of the face on the maxillary ridge. There is a possibility of some distortion in the specimens, but the differences appear to have existed in life. In *E. hatcheri* this width equals 38 per cent of the basilar length; in *E. niobrarensis*, 35.3 per cent; in the *E. caballus* measured only 34.2 per cent.

Attention may be called to the straightness of the outline of the skull, from the vertex to the front of the nasals (pl. 32). This profile is quite different from that of *E. niobrarensis*, and its form does not appear to be due to any distortion produced in restoring the skull.

The position of the hinder border of the vomer on the midline with reference to the lower lip of the foramen magnum and to the hinder border of the hard palate furnishes a character by means of which certain equids may be distinguished from others. On this matter the readers may consult tables given on succeeding pages. On account of injuries done in this region in the types of both *E. hatcheri* and *E. niobrarensis* the position of the vomerine notch can not be directly determined. Tests made on several skulls show that the distances of this notch from the two points mentioned are roughly proportioned to the distances from these two points to a small foramen situated just a little above and a little in front of the optic foramen. Estimates based on this assumption leave no doubt that the vomerine notch of *E. hatcheri* was somewhat nearer the palate than to the foramen magnum, and that it was considerably nearer the palate in *E. niobrarensis*, perhaps 25 mm. nearer. In a skull from Alaska described by the writer¹ and called *Equus niobrarensis alaskae* the distance from the vomerine notch to the foramen magnum is 121 mm.; that from the notch to the hard palate is 114 mm. This character may enable us to distinguish the Californian *E. occidentalis* from both *E. niobrarensis* and *E. hatcheri*. A skull of the western species described by Merriam² was sent to the American Museum of Natural History, where it has been examined by the writer. The distance from the foramen magnum to the vomerine notch is 122 mm.; from the notch to the hard palate, 141 mm. Merriam's figure of this skull³ shows the position of the notch. However, from information furnished by Merriam it appears that the vomerine notch is sometimes nearer the hard palate than the foramen magnum.

Measurements are here presented of the teeth, both upper and lower. For comparison corresponding measurements are furnished of the teeth of the type of *Equus niobrarensis* and those of the domestic horse. The upper teeth of the latter species are those of No. 843 of the National Museum, while the lower ones are those of No. 174960 of the National Museum, a very large horse with basilar length of 610 mm., whose upper tooth line is, however, only 1 or 2 millimeters longer than that of No. 843.

¹ Smiths. Misc. Coll., vol. 61, No. 2.

² Univ. Calif. Pubs., Geol., vol. 7, No. 21.

³ Idem, p. 399, fig. 3.

Measurements of teeth in millimeters.

Teeth.	Upper.			Lower.		
	<i>E. hatcheri.</i>	<i>E. niobrarensis.</i>	<i>E. caballus.</i>	<i>E. hatcheri.</i>	<i>E. niobrarensis.</i>	<i>E. caballus.</i>
Length molar-premolar series.....	187	179	185	188	180	187
Length premolar series.....	96	98	98.5	98	94	97
Length molar series.....	92	81	86	91	84	90
Pm2, length.....	40	38	40	40	35	36
width.....	28	27	27	16	15	16
protocone.....	11	10	10			
Pm3, length.....	30.5	30	30	30	28	30
width.....	31	28	29	18	16	17.5
protocone.....	15	13.5	14			
Pm4, length.....	30	29	29	30	30	30
width.....	30	27	30	17	16	17
protocone.....	14.5	14	15			
M1, length.....	28.5	17	27	29	27.5	27
width.....	29	28	29	18	14	15.5
protocone.....	14	13	15			
M2, length.....	27.5	27	28	28.5	27	28
width.....	27	25	28	16	13.5	15.5
protocone.....	14	14	16			
M3, length.....	30	26	31	35	30	34
width.....	24	23	25	15	13	14
protocone.....	15	14	16.5			
I1, diameter, side to side.....	15	19	16	14	17	16
diameter, fore and aft.....	13.5	13	11.5	11.5	11	11
I2, diameter, side to side.....	17.5	20	18	15	17	19
diameter, fore and aft.....	14	12	11	11	11	11
I3, diameter, side to side.....	18	21	20	12.5	17	17
diameter, fore and aft.....	14	11	11	13	11	13

When the upper grinding teeth of *E. hatcheri* (pl. 34, fig. 1; text-fig. 2) are compared with those of *E. niobrarensis* it is seen that they are in all cases longer, sometimes only slightly so, but in other cases 2 mm. or even 4 mm. longer. In width the differences are still greater. The lower teeth (pl. 33, fig. 2; text-fig. 3) are in all cases, except that of the hindermost premolar, greater in length than those of the type of *E. niobrarensis*, while, as in the upper teeth, the differences in the width are still greater. These differences must be taken into account in estimating the relationships of the two skulls. The differences in the lengths of the various cheek teeth, upper and lower, as compared with those of *E. niobrarensis*, would have been still greater if those of *E. hatcheri* had been measured at an earlier stage of wear. The differences among the dimensions of the corresponding incisors of the two species, certainly to a great extent, are due to greater wear in those of *E. hatcheri*.

It is proposed now to make careful comparison between the structure of the teeth of the fossil horse here described and that of the teeth of various specimens of the larger domestic horses; furthermore, to include in the comparisons the teeth of *Equus niobrarensis*. It is probable that not all of the differences observed among these horses will prove to be of specific importance, but it seems to be proper to note them in order that the important character may in due time be discovered.

It is observed that the outer styles of the upper teeth of *E. hatcheri*, both premolars and molars, are more strongly developed than in the domestic horses. In the third premolar, for example, the anterior style has a width of 8 mm., while in No. 843, referred to already, the width is only 5.5 mm.; in *E. niobrarensis* 6 mm. The median style of this premolar in *E. hatcheri* is 8 mm. wide; in No. 843, 7 mm.; in *E. niobrarensis* 5 mm. In the second molar of *E. hatcheri* the anterior style is 6.5 wide; the median style, 5.2 mm. In No. 843 the corresponding anterior style is 4 mm. wide; the median style, 5.5 mm.; therefore slightly larger than in *E. hatcheri*. In *E. niobrarensis*

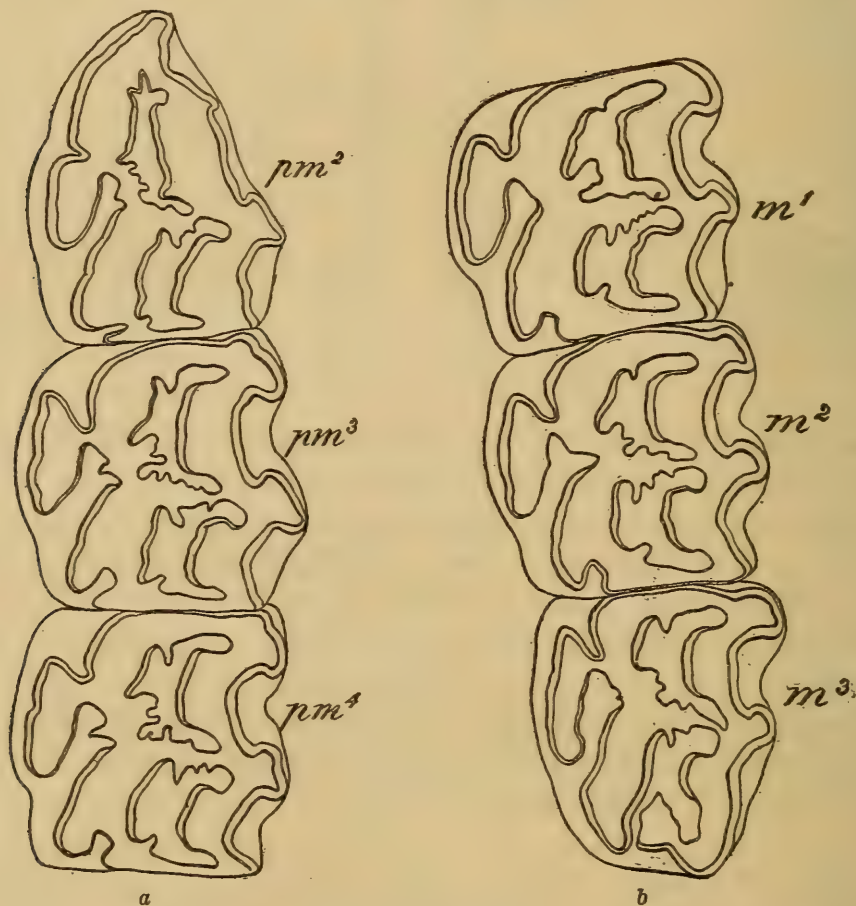


FIG. 2.—UPPER PREMOLARS (a) AND UPPER MOLARS (b) OF *EQUUS HATCHERI*. $\times \frac{1}{10}$.

the anterior style is 4 mm. wide; the median 4 mm. The anterior style in the premolars of the domestic horse are usually flattened, and a slight groove runs along the face from base to summit of the tooth. In *E. hatcheri* the outer face of the style is convex and a very shallow groove is seen near the front edge of the face, while the median style on the premolars shows only a trace of a groove; in the molars no indication of it.

In *E. hatcheri* the hinder border of the anterior style, especially of the third and fourth premolars, is turned strongly backward, so as to overhang conspicuously the valley which descends between the anterior and the median styles. This feature is seen likewise in the

molars, but not so strongly expressed. In the domestic horses observed the hinder border of the anterior style is not at all or only slightly rolled backward. In the Arabian horse skull (No. 172454, National Museum) the border turns rather strongly backward. In the type of *E. niobrarensis* it is not at all rolled backward. Probably in each species there is in this character a good deal of individual variation.

In all the cheek-teeth of *E. hatcheri* the inner face of the protocone is distinctly convex, whereas in the type of *E. niobrarensis* this face

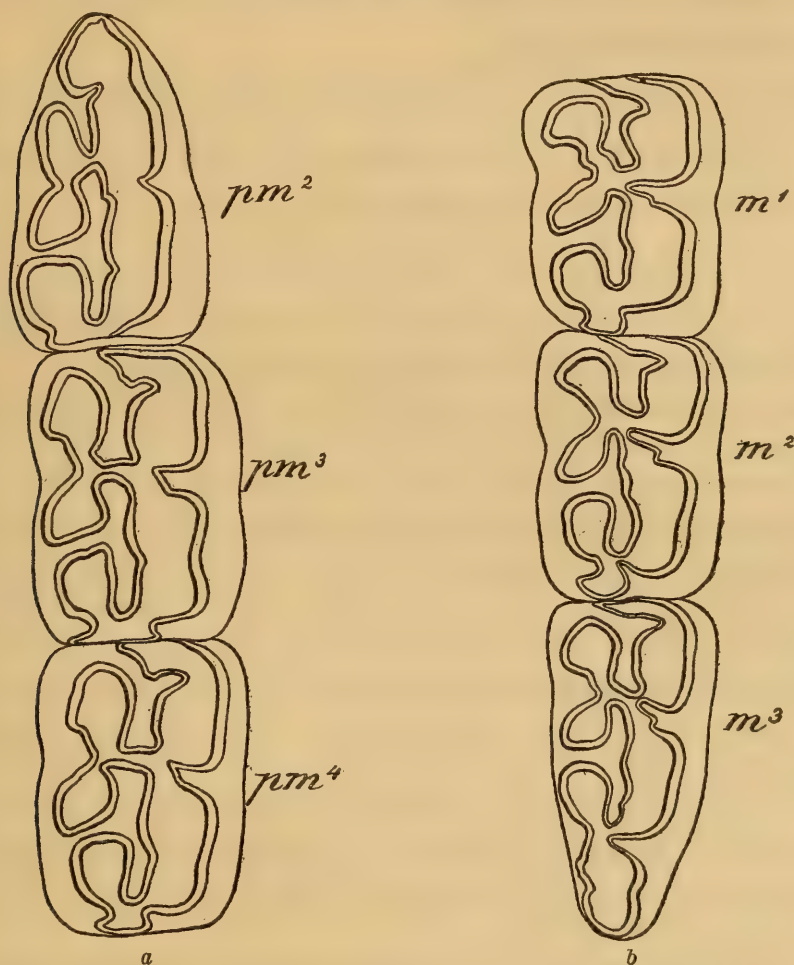


FIG. 3.—LOWER PREMOLARS (a) AND LOWER MOLARS (b) OF *EQUUS HATCHERI*. $\times \frac{10}{1}$.

of the protocone is divided by a distinct groove into an anterior lobe and a larger posterior one. In the domestic horses the inner face of the protocone is usually, but not always, either flat or somewhat concave.

As regards the plication of the enamel which surrounds the lakes in the upper molars, it may be said that no essential differences have been observed on comparison with the cheek teeth of the domestic horses. In the type of *E. hatcheri* the plication is less developed than in some domestic horses, more so than in others. Opposite the head of the anterior inner valley, at the hinder inner angle of the anterior

lake of *E. hatcheri*, there is in the molars, but more conspicuously in the premolars, a reëntering double fold, resembling somewhat an M. The homologue of this is usually present in the domestic horses, but is rarely so broad, and it is often only a simple fold.

Wilckens¹ concluded that the complication of the enamel surrounding the lakes of the upper cheek-teeth is far simpler in the Arabian horse than in what he called the occidental horses. His figures (pl. 9, fig. 5) represents the lakes as surrounded by enamel with little crinkling in the adjacent borders. In the Davenport Arabian horse the enamel of the lakes is more complicated than it is in many of the large domestic horses.

The anterior inner valley of the upper cheek-teeth of *E. hatcheri* is directed less outward than in the corresponding teeth of *E. caballus*; and, especially in the premolars, does not reach so near the center of the tooth as it does in the domestic horses.

The reëntering fold in the head of the anterior inner valley, so commonly seen and so deep in the premolars of the large domestic horses, is shallow in the premolars of *E. hatcheri* and absent in the molars, except in the last one, where it is a mere nick.

In the lower cheek-teeth of *E. hatcheri* the valley (pl. 34, fig. 2) seen at the middle of the outer face is shallower than in the greater number of domestic horses. In the premolars of the latter it reaches usually more than half way to the enamel of the inner face, while in the premolars of *E. hatcheri* it does not penetrate the tooth so deeply. In the molars of most specimens of *E. caballus* this valley forces itself between the longitudinal expansions of the two inner valleys and almost reaches the enamel of the inner face. In *E. hatcheri* the outer valley does not get in between the longitudinal expansions mentioned. The writer has seen relatively few specimens of the domestic horse in which the outer valley fails to push in between the longitudinal valleys of the molars, and a specimen is found now and then in which the condition is found in the premolars which prevails in the molars.

In *E. caballus* the outer valley of the lower cheek-teeth has, in both premolars and molars, a distinct reëntering fold in its hinder border. In *E. hatcheri* this fold is absent or small in the premolars and small in the molars.

In the upper cheek-teeth of *E. niobrarensis* the anterior inner valley sends forward and outward, behind the deep reëntering loop, a prolongation which reaches the center of the tooth. This great inner valley is quite different from that of *E. hatcheri*. In none of the teeth of *E. niobrarensis* is there found in the anterior lake a double M-like fold facing the head of the anterior inner valley. In

¹ Nova Acta, Acad. Caes. Leop. Car., vol. 52, p. 264.

the molars there is a single, rather deep reëntering fold; in the premolars, some small plications.

In the lower cheek-teeth of *E. niobrarensis* the valley which enters the tooth at the front of the inner face sends toward the outer face of the tooth a horn-like process which is narrower and longer than it is in *E. hatcheri* and the domestic horses. The wall which bounds outwardly the expansion of the hinder inner valley is much more strongly undulated than it is in *E. hatcheri*. To what extent these characters vary in different individuals of the two species must be left for determination to future research.

EQUUS FRANCISCI, new species.

Diagnosis.—A small Pleistocene horse which had apparently the size of *Equus tau* Owen, but which had the last premolar and the anterior two molars wider than long, instead of longer than wide. Enamel of cheek-teeth in simple pattern.

Type.—A nearly complete skull and considerable fragments of the skeleton. Found in Wharton County, Texas.

From Prof. Mark Francis, of the veterinary department of the Agricultural and Mechanical College of Texas, at College Station, the writer received a letter, dated May 27, 1913, in which an account was given of the discovery in that region of some remains of an extinct horse. The information communicated was that about February 1 a farmer living at or near a town by the name of Lissie, in the northern part of Wharton County, had, in digging a well, and at a depth of 25 feet, met with a skeleton of some animal. No effort was made to save the bones, but they were broken up with the pick and shovel and the fragments were thrown out on the dump. About ten days later Professor Francis learned of the discovery and went to the place to see what had been unearthed. He found the remains to be those of an extinct horse, and he secured most of the skull and many parts of the rest of the skeleton. The skull had been broken and some parts of it had been lost. It is quite probable that the complete skeleton was there and might with some efforts have been secured by the farmer.

The remains thus obtained were sent to Ward's Natural History Establishment, at Rochester, New York, for restoration. About April 1, 1914, they were sent to the writer for examination and description.

Professor Francis deserves credit for the zeal and intelligence which he has shown in saving this valuable specimen. He is continually watching for such discoveries, and as a result he has secured a large and valuable collection of the remains of many fossil vertebrates of his region. Furthermore, in doing so he has taken care to obtain all the possible information regarding the localities where they have been found and under what conditions.

The skull of this specimen is nearly complete (pls. 35, 36). A portion across the middle of the face is missing, and this has carried with it the right premolars. The molars of this side are present, as are the molars and the premolars of the left side. The first incisor of the right side is missing, the others are present. The lower jaw is present, but lacks the premolars of the left side and two of those of the right side. Attached to the skull was the atlas. Of the anterior limbs both radii are preserved, with little injury. Of the right hind leg there are present the patella, the tibia (lacking about the upper fourth), the astragalus, the calcaneum, the cuboid, and the third metatarsal, except some portions thereof. Of the left hind leg there are present a small part of the distal end of the tibia; all the bones of the ankle; the third metatarsal, excepting a part of the shaft; the proximal halves of the second and fourth metatarsal; and the first and second phalanges of the third digit. The hoof phalange is missing.

Besides these parts there is a considerable amount of fragments of limb bones, vertebrae, and the like, some of which will receive consideration.

All the bones are thoroughly fossilized. They were imbedded in a layer of sand and small gravel; and these materials were cemented together by calcium carbonate, thus forming a matrix which in places is hard and rather difficult to remove.

From a report published recently by Dr. Alexander Deussen of the United States Geological Survey,¹ it is learned that the deposits in question belong to the Lissie formation, named from the town above mentioned. This formation occupies a strip which runs across the State of Texas, parallel with the Gulf coast line, and having its southern border about 55 miles at the east from the coast. The strip has a width of about 25 miles wide in its western half. The formation consists mostly of gravels and conglomerates, in some places containing considerable limy materials. In the eastern part of the State there are red clays and ferruginous sands. It is believed that to this formation corresponds the middle of three terraces which are found along many of the large rivers of that State. It is supposed by Deussen that the materials of the Lissie formation were spread out at the mouths of the valleys of the streams which discharged into the sea during some parts of the Pleistocene, probably the early and middle parts.

The present writer is inclined to believe that the Lissie belongs to the early Pleistocene, corresponding, in part at least, to the Aftonian. From Hardin County was obtained *Equus complicatus*, associated with the saber-tooth tiger *Smilodon fatalis* and two extinct species of fresh-water tortoises. The great ground sloth *Megatherium* has

¹ U. S. Geological Survey, Water-supply Paper No. 335.

been found in two places along the Brazos River. In Nueces County, probably in the same formation, Cope reported *Equus* associated with a camel; and from the same region he described a *Glyptodon*. From Bee County there have been obtained remains of *Elephas imperator* and *Bison latifrons*, probably too *Bison regius*. From about San Diego have been described four species of extinct horses.

A study of the remains seems to show that this horse is more closely related to *Equus tau* Owen, than to any other yet described. Indeed it is possible that it belongs to that species, but there are certain features which appear to mark the animal as being more primitive than Owen's species, and it seems, therefore, better for the present to give it a distinct name. This shall be *Equus francisci*, in honor of the discoverer. For figures of the skull see plates 35, 36, and 37.

The following are the measurements of the skull. In the second column are the corresponding measurements of a specimen of *Equus hemionus*, which was collected by Dr. W. L. Abbott, on the Hanlé River, in Kashmir:

Measurements of skulls in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>
From middle of incisive border to rear of occipital condyles.....	438	470
From middle of incisive border to front of foramen magnum.....	414	445
From middle of incisive border to rear of hard palate.....	210	222
From middle of incisive border to naso-premaxillary notch.....	133	153
From middle of incisive border to middle of occipital crest.....	460±	498
From middle of incisive border to front of pm ²	110	108
From middle of incisive border to rear of orbit, direct.....	328	356
From middle of incisive border to front of orbit.....	270	291
From middle of incisive border to notch at rear of vomer.....	310	341
From middle of incisive border to middle of line joining rear of orbits (facial length).....	316	340
Width across mastoid region.....	100	105
Width at glenoid fossae.....	167	198
Width from outside to outside of last molars.....	99	116
Width from outside to outside of last premolars.....	100	112
Width from outside to outside of canines, at base.....	50	61
Width from outside to outside of outer incisors, at base.....	68	69
Width of skull at the front of the orbits.....	130±	137
Width of the skull at the rear of the orbits.....	175±	203
Width of skull on maxillary ridge at maxillo-malar suture.....	152±	166
Width of palate at last molars.....	57	74
Width of palate at pm ²	40±	45
Width of palate at diastema, least.....	39	46
Length of orbit.....	60	60
From front of symphysis of lower jaw to rear of ascending ramus.....	352	375
From front of symphysis to rear of condyle.....	380	405
Length of symphysis.....	54	72
Height of jaw at front of m ¹	70	78
Elevation of condyle above lower border of jaw.....	195	215
From rear of third incisor to front of pm ² (diastema).....	72	76

In the above measurements of *E. francisci* certain dimensions can not be determined with absolute accuracy, as is indicated in the table. However, all of these, except perhaps the fifth, are so close to the true values that the deviations may be neglected. The occipital crest is broken away so badly that its border can not be determined exactly. Although a considerable section is missing from the skull in the region of the premolars, the connection of the snout

with the premolar on the left side is such as to show very accurately the relation of the parts.

If now we multiply the width of the skull at the rear of the orbits, 175, by 100 and divide the result by the basilar length, 414, we obtain the cephalic index, 42.3. That of *Equus hemionus*, is 44.4, which is somewhat less than that of a specimen measured by Tscherski. On referring to the tables on pages 559 and 560, the reader will find that the Texan skull is intermediate in width between the narrow-faced horses and the broad-faced ponies.

The facial index (facial length \times 100 \div basilar length) of the Texas specimen is 76.1, that of *E. hemionus* 76.4. The face of both these animals is, as shown by the tables referred to, rather long. The length of the nose of the Texas specimen makes 27.3 per cent of the basilar length; in *E. hemionus* the corresponding index is 24.2. In the Arabian horse (No. 172454 Nat. Mus.) this index is 26.4. Hence the Texas horse had a relatively long nose. The tooth row is relatively very short, forming only 30.4 per cent of the basilar length; while in the specimen of *E. hemionus* it forms 34.1 per cent, and in the Arabian horse 34.5 per cent. In a very large horse skull in the National Museum (No. 174960), with a basilar length of 610 mm., the index of the tooth line is 30.6. The basioccipital bone of *E. francisci* is different from that of any of the other horses at hand. In all of them and in *E. hemionus* this bone, immediately in front of the articular surfaces of the condyles, slopes away gradually on each side. In the Texas horse the sides are nearly perpendicular. The thickness of the bone from side to side is 20 mm. The distance from the lower border of the foramen magnum to the notch on the hinder end of the vomer is 111 mm.; from the notch to the hinder border of the hard palate 100 mm. In this respect the skull of *E. francisci* agrees with the true horses and differs from the domestic ass and from *E. occidentalis* of California.¹ The hard palate ends in the midline opposite the middle of the length of m². The posterior palatine foramina are situated on the line joining the hinder ends of the second molars. There is no indication of any pit on the side of the face in front of the orbit.

The teeth (pl. 35; figs. 1, 2; text-figs. 4, 5) have furnished the following measurements. In the second column are expressed the measurements obtained from Owen's figure of *Equus tau*; in the third column the measurements of the teeth of *E. hemionus*.

¹ See page 530.

Measurements of the upper teeth in millimeters.

	<i>E. francisci.</i>	<i>E. tau.</i>	<i>E. hemionus.</i>
Premolar-molar series, length.....	135	.....	151
Premolar series, length.....	74	.....	81
Molar series, length.....	61	65	70
Pm ² , height.....	55±	.....	.....
length.....	28	.....	32
width.....	23	.....	24
protocone.....	8	.....	8
Pm ³ , height.....	60	.....	.....
length.....	23	23	25.5
width.....	23	20	26
protocone.....	10	10.5	12
Pm ⁴ , height.....	56	.....	.....
length.....	21	23	24.5
width.....	23	19	26
protocone.....	10.5	10	13
M ¹ , length.....	19.5	21	22.5
width.....	22	20	23
protocone.....	11	11	11.5
M ² , length.....	20	22	23
width.....	21	18.5	23
protocone.....	12	11.5	14
M ³ , length.....	21	25	24
width.....	18	16	20.5
protocone.....	12	11	15

In the lower jaw there are present all the incisors, the three molars of both sides, and the last premolar of the right side (pl. 37, figs. 1, 2; text-fig. 5). The following measurements are obtained:

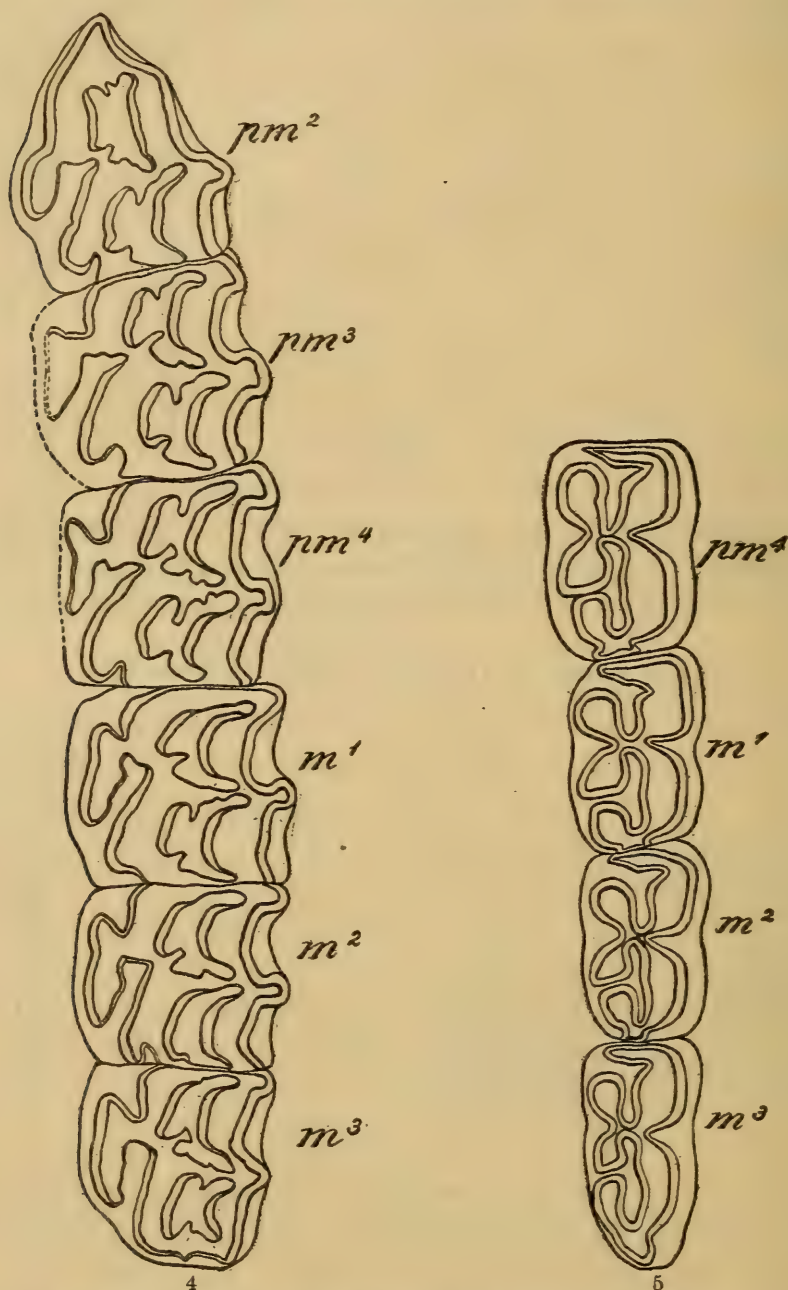
Measurements of the lower teeth in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>
Length of the molar series.....	66	72
Pm ₃ , length of grinding face.....	22	23.5
width of grinding face.....	14.5	16
M ₁ , length of grinding face.....	20	21.5
width of grinding face.....	13	14
M ₂ , length of grinding face.....	20	22
width of grinding face.....	12.5	14.5
M ₃ , length of grinding face.....	24	29
width of grinding face.....	12	13
I ₁ , diameter from side to side on grinding surface.....	12.5	.....
diameter from front to rear on grinding surface.....	7.5	.....
I ₂ , diameter from side to side on grinding surface.....	12.5	.....
diameter from front to rear on grinding surface.....	6	.....
I ₃ , diameter from side to side on grinding surface.....	15	.....
diameter from front to rear on grinding surface.....	5.5	.....

Owen did not furnish any measurements of the upper teeth which formed the type of his species; but if we may depend on the measurements taken from his figure, as it appears probable that we may, certain differences between the two specimens appear at once. All of the teeth of Owen's type are considerably longer than wide. In *E. francisci*, if the anterior premolar and the hindermost molar are excepted, the teeth are as wide as long or wider than long. This difference is so great that it appears at once to stamp the two individuals as belonging to distinct species. A study of the teeth of the Texan specimen shows that the arrangement of the enamel forms

a quite simple pattern, approaching in this respect some of the species of *Protohippus*.

In all the upper premolars and molars the styles descending on the outer face are strongly developed, those of the premolars being distinctly broader. The protocones (anterior internal columns) are



FIGS. 4-5.—4, UPPER PREMOLARS AND MOLARS. 5, LOWER LAST PREMOLAR AND MOLARS. SLIGHTLY LESS THAN NATURAL SIZE.

large, the length in the case of the molars being equal to one-half or more of the length of the grinding face of the tooth; and each extends well forward of its connection with the antero-median column (protoconule). The internal face of each column is nearly flat. The anterior internal valley is rather narrow and is furnished with no reëntering loop at its anterior end, except that in M_3 there is a very

small loop. In the premolars this valley has its axis directed toward the front of the median style of the next tooth in front. In the molars it is directed still farther forward, to the anterior outer style of the next tooth in front or even to the rear of the second tooth in front. In all cases it lacks much of reaching to the center of the tooth. The fold of enamel which in the most of the horses extends forward between the postero-internal column (hypocone) and the postero-median column (metaconule) is small in the premolars, extremely small in the front two molars, and missing in the last molar. The small size of this fold constitutes an approach to *Protohippus*.

The walls of enamel surrounding the lakes of each tooth are little complicated; least so in the molars. In the premolars there is a small reëntering fold in both the front and the rear sides of both the lakes, with perhaps some additional undulations of the enamel. In the molars there is no infold in the front of the anterior lake and only a very small one in the hinder wall of the posterior lake. The hinder border of the anterior lake has a small infold opposite the head of the anterior internal valley. The front border of the posterior lake is slightly more complicated, there being an infold and two or three undulations in the enamel. In the first upper incisor the median longitudinal ridge is obsolete, so that the front of the tooth from side to side is concave. In the third incisor the ridges all appear to be obsolete. In the lower incisors the median groove is broad and shallow.

The writer proposes to describe with as much exactness as he can and as briefly as is consistent with this exactness such of the bones of the trunk as have been preserved.

In making these measurements the writer has consulted especially the paper of Nehring¹ and that of Tscherski² and has endeavored to make the measurements conform as far as possible with those of those authors; but the number of measurements is here reduced. It is thought well to make the following explanations. In measuring the bodies of the vertebrae the distance is taken between the point on the anterior articular surface farthest in front and the point farthest in front on their hinder articular surface, this being usually nearly from center to center. The other measurements of the vertebrae do not need explanation. The length of the scapula is taken from the front of the glenoid cavity, along the spine, to the line which separates the endosteal bone from that of the main part of the scapula.

In the case of the humerus the total length is the distance from the upper end of the ridge between the two bicipital grooves to the distal end. The length of the radius is measured on the outer border of

¹ Landwirthsch. Jahrb., vol. 13, 1884, p. 81.

² Mem. St. Petersb. Acad. Sci., ser. 7, vol. 40, pp. 257-383.

the bone from the middle of the outer edge of the articular surface for the humerus to the surface for union with the cuneiform bone, really the lower end of the ulna. This is one of Nehring's measurements, as understood by the present writer.

The median metacarpal is measured on the outer border from one articular surface to the other.

The first phalange is measured on the outer border, beginning above at the middle of the outer border of the upper articular concavity. The length of the second phalanx is obtained in the same way. In these cases we obtain the efficient length, but not the total length. The middle of the length of the femur is midway between the upper surface of the head of the bone and the internal condyle. The lengths of the median metatarsal and of the phalanges are obtained as in the fore foot.

There are present 12 presacral vertebrae; but most of these are more or less injured, and only a part of the desired measurements can be obtained. For comparison, the corresponding vertebrae of *E. hemionus* and of the Arabian horse are furnished. The atlas has lost a part of the right wing. The following are some of the dimensions of the bone, a part of them estimated, but they may be relied on.

Measurements of the atlas in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Length of the upper arch at the midline.....	38	41	52
Width in front, across the anterior foramina.....	110	110	136
Width in the rear, across the hinder foramina.....	110	127	150
Distance across the articular surface for the occipital condyles.....	73	75	90
Width across the articular surfaces for the axis.....	67	77	92

The atlas of the fossil species differs from that of the Arabian horse in having the same width in front as in the rear, instead of widening backward; but variations may here be looked for. In the Arabian the lateral wings droop considerably, so that if a line be drawn from the border of one to that of the other, passing just behind the tuberosity on the lower face of the lower arch, this line will fall much below the border of the articular surface, while in the fossil species the line will touch the border of the articular surfaces at the midline. In *E. hemionus* the line falls a very little below the articular surface. In the fossil the distance across the anterior articular surfaces is greater, as compared with the length along the upper arch, than in the Arabian horse.

The axis is represented by only a fragment which clings in the matrix in the rear of the atlas. The bone was undoubtedly present in its natural position when the skeleton was found.

What appears to be the third cervical is represented by the hinder part. Its length can not be determined. The width across the hinder articular processes was very close to 64 mm. In the Arabian horse it is 70 mm. The width of the hinder articular cup is 34 mm.; in the Arabian, 45 mm. At about the middle of the length the spinal canal had a height of 22 mm. and a width of 24 mm.

The first dorsal is in part present. The anterior end and most of the spinous process are missing. The distance from the outer border of the articular cup for the head of the rib to the corresponding point on the opposite side is 51 mm.

The second dorsal is represented by the greater part of the body and the base of the spinous process.

Measurements of the second dorsal vertebra in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Length of the centrum.....	38	38	45
Vertical diameter of anterior articular head.....	27	29	36
Lateral diameter of anterior articular head.....	28	27	33
Width from outside to outside of hinder cavities for head of ribs....	50	56	60

What appear to be the sixth, seventh, and eighth dorsals are articulated together and still partly enclosed in the matrix. The spinous processes are missing. The length of the three centra taken together is 96 mm. In the Arabian horse the corresponding measurement is 110 mm. On the left side of the three vertebrae are the cavities for the heads of three ribs, while on the right side there are the bases of three ribs. Three other dorsals, much damaged, form a mass and bear with them the bases of two ribs.

The lumbar vertebrae are represented by the first, second, third, and the hindermost. The spinous processes are missing from all and the lateral processes from all except the hindermost. A part of the articular head of the first is gone. The length of the three centra, taken together, was very close to 122 mm. The dimensions of the third lumbar are as follows:

Measurements of the third lumbar vertebra in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Length of centrum.....	39	41	42±
Height of anterior articular surface.....	27	26	32
Width of anterior articular surface.....	30	35	48
Height of posterior articular surface.....	23	22.5	-----
Width of posterior articular surface.....	37±	43	51
Distance across anterior articular processes.....	34	40	45

The hindermost, fifth or sixth, lumbar of the specimen is attached to the first sacral. The spine is gone and the outer ends of the trans-

verse processes are broken off. The following measurements are secured:

Measurements of the supposed sixth lumbar vertebra in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Length of centrum.....	± 37	37	± 40
Distance between extremities of lateral processes.....	± 185	160	212
Height of anterior articular surface of centrum.....	20	20	23
Width of anterior articular surface of centrum.....	37	47	53
Height of spinal canal, in front.....	19	16	30
Width of spinal canal, in front.....	24	24	32

The sacrum consists, as usual, of 5 vertebrae, and these are consolidated. The spines are all broken away, except the first one. The following measurements are secured:

Measurements of the sacrum in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Total length of the sacrum along midline.....	173	175	180
Distance in front between tips of lateral processes.....	± 166	157	211
Distance from outer end of one lateral articular surface for last lumbar to corresponding point on other side.....	118	122	165
Width at level of front pair of foramina.....	75	71	95
Width at level of third pair of foramina.....	48	45	66
Width of hinder end of fifth centrum.....	27	22.5	28

As will be observed, the sacrum of *E. francisci* lacks but little of being as long as that of the Arabian horse. On the other hand, it is much narrower. Other differences are noted. The free borders of the vertebrae behind the first are in the fossil quite acute, while those of the Arabian horse are thick and rounded. In the latter animal the underside of the sacrum is nearly flat from side to side, the free border just described rising but little above the floor of the spinal canal. In *E. francisci* the sharp border rises at the middle of the third sacral nearly to a level above the middle of the height of the canal. The first vertebra of the tail is preserved. The length of the centrum is 32 mm. The width across the lateral processes at their hinder end is 45 mm.

A fragment of each scapula is preserved. In each there is a triangular piece which presents the coracoid process and the anterior half of the glenoid cavity. The latter has a side to side diameter of 38 mm. In *Equus hemionus* the corresponding diameter is 42 mm. The anterior border rises to a distance of 80 mm. above the lower end of the coracoid.

The humerus is represented by the proximal end of the bone of the right side and the distal end of that of the left. It is impossible to

determine the length of the bone. The following dimensions are given as in the species compared :

Measurements of the humerus in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Length, total.....	-----	260	317
Length from upper surface of the head to inner side of distal end.....	-----	236	300
Diameter, through the head and tuberosities, greatest.....	75	83	-----
Diameter, greatest at middle of length.....	-----	42	50
Diameter, side to side at middle of length.....	28±	30	37
Diameter, across the lower articular surface.....	60	63	80

The left radius has missing a part of the shaft, but the fragments connect in front. The right radius is complete and is accompanied by a part of the proximal end of the ulna. The following are the measurements secured. In the second column under each specific name are presented, as indices, the value of each measurement when compared with the length taken as 100.

Measurements of the radius in millimeters, with indices.

	<i>E. francisci.</i>		<i>E. hemionus.</i>		Arabian.	
	Mm.	Indices.	Mm.	Indices.	Mm	Indices.
Length from articular surface above to that below, on outer border of the bone.....	288	100	300	100	352	100
Diameter of upper end, greatest.....	69	24	69	23	85	24.2
Diameter at middle of length, fore and aft.....	23	8	23	7.7	29	8.2
Diameter at middle of length, side to side.....	33	11.4	35	11.7	40	11.3
Diameter at lower end, greatest from side to side.....	59	20.5	66	22	80	22.7
Distance across lower articular surfaces, side to side....	49	16	54	18	67	19

An examination of this table shows that the radius of *E. francisci* stands in slenderness between that of *E. hemionus* and the Arabian horse, but the distal end is narrower than that of either of the two last named. It is to be observed further that this radius lacks only 2 mm. of being as long as that of the horse whose limbs are in this paper assigned provisionally to *E. laurentius* (p. 569), while the diameters at the middle of the length are far less. The ulna, at the rear of its union with the radius, has a diameter of 33 mm. In *Equus hemionus* it is 42 mm.

Of the ossa innominata there are present three fragments of the right side and four of the left. All parts of the latter are present except the anterior outer process of the ilium, that part of the ischium which enters into the acetabulum and forms most of the hinder boundary of the ischiopubic foramen, and the tuberosity. From the fact that some fragments of the pelvis are missing it is not possible to give all the measurements desired. If a line be drawn from the extremity of the suprailiac crest to the ischial border of the os innominatum, at right angles to this border and following the curvature of the bone, the distance is 175 mm. In *E. hemionus* the dis-

tance is 170 mm. Where the ilium is narrowest the diameters are 34 mm. and 20 mm. In *E. hemionus* the corresponding diameters are 32 mm. and 17 mm. The distance from the middle of the superior border of the acetabulum, measured along the axis of the ilium, to the anterior border is almost exactly the same in the two species, 187 mm.

In *E. francisci* the pubic border continues forward as a sharp ridge much further than it does in *E. hemionus*, in which it disappears at a point about 50 mm. in front of the acetabulum. As the hinder portion of the acetabulum is missing the diameter of this can not be determined. The left pubis as preserved appears to reach the symphysis, and there is also a fragment of the right one. The distance from the symphysis in a straight line to the outside of the acetabulum is 106 mm., the same as in *E. hemionus*. The anterior border is sharper than in the latter animal, while that part which forms the anterior boundary of the ischio-pubic foramen is nearly flat. The section of the pubis at this point is thus triangular.

The size of the ischio-pubic foramen can not be determined, but it must have been much larger than in *E. hemionus*, where the greater diameter is only about 40 mm. In the Texas horse it could hardly have been less than 60 mm. It is further evident that the ischium extended backward a considerably less distance than in *E. hemionus*. In the latter the distance from the hindermost border of the ischio-pubic foramen to the hinder border of the ischium, measured 20 mm. from the symphysis, is 110 mm.; in *E. francisci* the distance is 75 mm., but this diminution is partly due to the greater size of the foramen. The ischial tuberosities are missing in the Texas specimen. In *Equus hemionus* the thickness of the bone between the two foramina is 25 mm.; in *E. francisci* about 10 mm.

The right femur is represented by the head and trochanters and by that part of the distal end which bears the articular surface for the patella. Of the left femur there are present the head and a part of the great trochanter, a portion of the shaft, and the inner half of the distal end. The latter part is broken into two pieces, one being the condyle, the other the tuberosity for the support of the patella.

Measurements of the femur in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Length of the femur, total.....		342	425
Length of the femur from head to distal end, inner side.....		308	380
Diameter through head and great trochanter.....	91	98	120
Diameter of head, fore and aft.....	48	43	61
Greatest traverse diameter at middle of length.....	±50	46	47
Greatest side to side diameter at distal end.....		81	100
Diameter of inner condyle, side to side.....	27	30	37
Diameter of outer condyle, side to side.....	26	28	35
Greatest side-to-side diameter through ridges bounding groove for patella.....	53	52	64

The greatest diameter at the middle of the femur is taken through the ridge which descends from the third trochanter. This is more prominent in *E. francisci* than in *E. hemionus*. Also, as shown by section, the marrow cavity in *E. hemionus* is of less diameter than is the fossil species, and the bone of the shaft is considerably thicker. In the fossil the ridge which descends from the lesser trochanter is more prominent than in *E. hemionus*.

Both patellae are present.

Measurements of patella in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Total length.....	54	57	74
Greatest width.....	55	56	74
Greatest thickness.....	26	27	.....

The tibiae are represented by a fragment of the upper end of that of the left side; that is, the articular surface for the outer condyle of the femur. There is also a large part of the shaft of the one of the right side, including the distal end; also a part of the upper articular surface for the inner condyle of the femur. The length of the bone can not be determined with exactitude, but by comparison of similar surfaces and markings it is estimated that the length was not much less than that of the tibia here assigned to *Equus laurentius* (p. 569), which is 322 mm. The total length of the fragment of the right tibia is 220 mm. The nutrient foramen is not present, but could not have been far away.

Measurements of the tibia in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Total length.....	.....	332	380
Diameter of upper end, greatest, side to side.....	.....	83	102
Diameter at middle of length, fore and aft.....	±30	29	36
Diameter at middle of length, side to side.....	±35	37	40
Diameter at distal end, side to side.....	55	63	80
Diameter at distal end, fore and aft.....	38	40	51

The diameters taken at the middle of the length are very close to the true ones. The difficulty is, of course, to determine exactly where the middle of the length is. The fragment of the left tibia does not extend across the proximal end. The surface for the outer condyle of the femur measures along its outer border 44 mm.; along the diameter at right angles to this, 36 mm.

All the bones of the left hind foot are present except the hoof phalange and the sesamoids. Parts of the shaft of the third metatarsal are gone, but there is connection throughout the length of the bone. The distal halves of the second and fourth metatarsals are

gone. Of the right foot there are present the astragalus, the calcaneum, the cuboid, three fragments of the third metatarsal and the upper third of the second. To the writer it appears possible that the second phalange in the mounted left hind leg is really that of a fore foot, since the width of its upper articular surface is about 3 mm. greater than that of the distal end of the first phalange. The astragali of both sides are complete.

Measurements of the astragalus in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Length of longest diagonal across upper articular surfaces.....	60	65	80
Width across distal articular surface.....	40	42	56

Both calcanea are preserved. The following measurements are presented:

Measurements of the calcaneum in millimeters.

	<i>E. francisci.</i>	<i>E. hemionus.</i>	Arabian.
Extreme length.....	96	104	119
Depth of tuber calcis at middle of length.....	38	38	44

The navicular has a side-to-side diameter of 39 mm. and a thickness of 9 mm. in front. The external cuneiform has corresponding diameters of 38 mm. and 11 mm.; the middle cuneiform measures on its hinder face 27 mm. from side to side; vertically, 16 mm. The cuboid has the greatest diameter, 34 mm.; the vertical diameter, 21 mm.; and the side-to-side diameter, 14 mm. At its distal end each presents an articular surface for the fourth metatarsal. The greater part of both third metatarsals is preserved. That of the right side is in three pieces and portions between them are missing. On the left side the bone is continuous from one end to the other. The following measurements and indices are furnished:

Measurements of the third metatarsal in millimeters, with indices.

	<i>E. francisci.</i>		<i>E. hemionus.</i>		Arabian.	
	mm.	indices.	mm.	indices.	mm.	indices.
Length along outer border.....	225	100	257	100	290	100
Side-to-side diameter at upper articular surface.....	39	17.3	39	15.1	53	18.3
Fore-and-aft diameter at middle of length.....	25	11.1	25	9.7	33	11.3
Side-to-side diameter at middle of length.....	26	11.2	27	10.5	33	11.3
Distance across lower articular surface.....	34	15.1	40	15.5	53	18.3

A study of this table shows that while the median metatarsal of *E. francisci* is a shorter bone than that of either of the other species, it is intermediate between them in its diameters relatively to its

length. The bases of the second and fourth metatarsals of both sides are present, but as their distal ends are missing nothing can be determined regarding their length. The greatest diameter at the base of the second is 15 mm. The greatest diameter of the fourth somewhat below the articular surface is 22 mm. The corresponding diameter in the same bones of *Equus hemionus* are, respectively, 14 mm. and 20 mm. The first and second phalanges of the third digit present the following measurements and indices:

Measurements of phalanges of hinder foot in millimeters, with indices.

	<i>E. francisci.</i>		<i>E. hemionus.</i>		Arabian.	
	mm.	indices.	mm.	indices.	mm.	indices.
Length of first phalange along the outer border.....	69	100	70	100	81	100
Width across upper end, greatest.....	36	52.2	43	61.4	58	71.5
Side to side diameter at middle of length.....	21.5	31.2	25	35.7	33	40.7
Width across distal articular surface.....	29	42	33.5	47.8	45	55.5
Length of second phalange along the outer border.....	28	100	36	100	36	100
Width across upper end.....	34	120.4	39	108.3	55	152.7
Width across lower articular surfaces.....	29	103.6	35	97.2	51	141.6

It will be observed that the first phalange has almost exactly the same length as that of *E. hemionus*, but in all of its diameters it is smaller. On the other hand, the second phalange is considerably shorter but relatively broader. None of the hoof phalanges of *E. francisci* has been preserved.

On making a comparison between the lengths of the radius, the third metatarsal and the hinder first phalange of *E. francisci* with the lengths of the corresponding bones of the Davenport Arabian horse, already mentioned as having had a height of 14.2 hands, the conclusion is reached that the former had a height at the shoulders of about 11.4 hands, 45.6 inches, 1,159 mm. Accepting this result and making a computation as to the relative sizes of the head in the two species, it will be found that that of *E. francisci* ought to have a basilar length of 395 mm.; this length is, in fact, 414 mm.

3. MEASUREMENTS AND INDICES OF SKULLS OF VARIOUS EQUIDS.

It is not the intention of the writer to enter upon any exhaustive discussion of the horses of the Pleistocene of Europe. It would require much time to study the abundant literature on this subject; likewise, the opportunity would be needed to examine at first hand the materials which have accumulated in European museums. Nevertheless, it must be granted that the American species of *Equus* are closely related to those of the Old World, and that in the study of the former the latter must not be neglected. Researches in Europe have demonstrated that in that country wild horses, resembling closely some of the domestic breeds, have existed from the time of the late Pliocene down to historical times. How these were related to the

domestic races and breeds has been and is yet a much-discussed question. Although some authors have held the opinion that the domestic horse was introduced into Europe by westward-wandering primitive men, there has been exhibited more recently a strong tendency to regard all the forms of *Equus caballus* as either the descendants of a primitive race of this species or as the product of the mingling of two or more races, all of which lived in Europe and to all of which the name *caballus* is to be applied. Lately there has been shown again a disposition to withdraw from the abundant Pleistocene forms some which are to be regarded as distinct species. So far as this can be done safely it will greatly assist in clarifying the situation.

One who examines even only cursorily the literature on European Pleistocene horses and on the derivation of our domestic horses must be struck by the lavishness which has been exhibited in the application of systematic names. Sanson recognized eight species, or races, of existing horses belonging to the form known as *Equus caballus*, and to these were given trinomial names; but before Sanson's time Fitzinger described 5 distinct species; 23 races, whose names were expressed by trinomials; and about 120 breeds, for which quadrinomial names were coined. And the employment of quadrinomials appears not yet to have ceased.

Dr. Ewald Wüst has published¹ a description and illustrations of a fossil horse which he regarded as a new species. This horse had been found near Süssenborn, Thuringia, in a deposit of gravel which Wüst believed had been laid down during the first interglacial stage. This would correspond to our own Aftonian. The type of Wüst's species presents the cheek-teeth of the upper and the lower jaws. On account of the extraordinarily large size of these teeth, because of the complexity of the enamel of the lakes and especially of the great inner valley, and because of the deep grooving of the protocone, and finally because of certain features in the lower premolars and molars, the present writer believes that this horse forms a species entirely distinct from anything to which the term *Equus caballus* can with any kind of propriety be applied.

One can hardly praise too highly several of the disquisitions which have been written on the osteology of the horse, in which the utmost patience and exactitude have been shown in taking measurements and in correlating them. Nehring² especially indicated a Pleistocene element, which has entered into the formation of the larger and heavier races of domestic horses, and suggested the origin of the smaller forms. Nevertheless, to the writer it appears that to Ewart and Stej-

¹ Abhandl. naturf. Gessellsch. Halle, vol. 23, 1901, pp. 287-296, pls. 6, 7.

² Landw. Jahrb., vol. 13, 1884, p. 156.

neger must be given largely the credit for having put the matter on a basis which appears likely to prove satisfactory. According to Ewart's results the modern breeds of horses are mixtures in varying proportions of three distinct forms. The first of these has been called by him *Equus caballus celticus* and, according to him, is represented by small horses found in Iceland, in Connemara (Ireland), in the Hebrides, and the Faroe Islands. The second form is the horse known as *Equus przewalskii*, which exists now wild in the desert of Gobi. The third form has been named by Ewart the Norse, or Forest, horse, and is represented, according to him, by certain horses which occur in northern Europe, especially in northern Scotland. Ewart was inclined at first to regard the Celtic pony as a distinct species; but in an important paper¹ published in 1907 he speaks of it as the Plateau, or Celtic variety. Ewart's characterization of the Forest horse is presented in the work just mentioned, but more fully in the Proceedings of the same society (vol. 26, 1906, p. 8). The Przewalsky horse is designated by Ewart the Steppe variety.

In 1907² Stejneger pointed out that the Celtic pony is found commonly along the entire western coast of Norway and is known as the fjord horse. He associated it with the tarpan, a horse of the steppe region of southern Russia, and regards these two horses as constituting a distinct species. As a representative of Ewart's Norse, or Forest, horse Stejneger mentions another horse of Norway, occupying the interior and eastern part of the country and known as the Gudbrandsdal horse. This, too, he looks upon as a distinct species, which includes the various heavy European horses, which must bear the name *Equus frisius* (Boddaert).

Ewart concluded that (1) the Forest horse is characterized by a short, broad, and dished face, which is not much bent on the base of the skull; that (2) the Plateau, or Celtic, variety has a narrow skull, with broad brain case and with the face little bent on the basicranial axis; while (3) the Steppe variety has a long, narrow skull, in which the axis of the face makes a large angle with the basicranial axis.

There exists a great amount of confusion regarding the types of horses involved in the discussion and regarding their characteristics. Ewart and Stejneger appear to be agreed that the Celtic ponies and the fjord horses belong together. Ewart has announced as a feature which distinguishes the Celtic pony from his Forest horses the narrowness of the skull of the former. On the other hand, Stejneger³ has given the measurements of a skull of a pony from the Loffoden Islands, the cephalic index, of which, obtained by dividing the frontal width by the basilar length and multiplying by 100, equals 46.

¹ Trans. Roy. Soc. Edinburgh, vol. 4, pp. 555-587.

² Smiths. Misc. Proc., vol. 48, p. 469.

³ Idem, p. 473.

Ewart,¹ too, has furnished some measurements and indices obtained from another skull of a Celtic pony. He has not given the basilar length of the specimen; but a careful estimate shows that this must have been close to 437 mm. Its celphalic index is, therefore, very close to 43.7. While the latter falls somewhat below the former, the indices show that both horses belong among those called by Nehring broad-faced. These two horses will be referred to later; but the writer does not at present see how Ewart's Celtic horses and his Forest horses are to be distinguished by means of skull measurements.

In 1908² Duerst discussed the origin of the various races of domestic horses. He, too, concluded (pp. 399, 431) that our modern breeds have arisen from three types, to which he applied the names "the type of the steppe," "the type of the desert," and "the type of the woods." These names do not, in all cases at least, correspond to those employed by Ewart. Duerst's steppe horse is represented by Nehring's *Equus caballus germanicus robustus*; his "type of the woods," or "forest type," has as its representative *Equus caballus nehringi*, from which, in Duerst's opinion, sprang the Celtic pony; finally, Duerst's type of the desert is his "*Equus caballus pumpellii*," which is "ancestrally closely related to the *Equus przewalskii* Poljakoff." These views illustrate the confusion of the subject; but, what is more important, they seem to justify the view that nobody knows exactly how forest horses, steppe horses, plateau horses, and desert horses differ one from another.

Much time and patience and talent have been expended in measuring the skulls and other bony structures of the domestic horses, and many "indices" have been determined. *Equus caballus* may be regarded as the product of two or three distinct races or species and as having been greatly affected by domestication and breeding. Under these conditions it is proper to inquire whether any of the indices obtained from the skulls of this group are of any value in distinguishing species; and if so, which ones? Also whether they can be employed in determining the ancestors from which the domestic horses have come. It seems essential that these indices should first be tested on unmixed and undomesticated species; and there appears to be no reason why this should not now be done. Already many measurements of *Equus asinus*, *E. hemionus*, and *E. przewalskii* have been published, besides those of a few species of zebras. In the United States National Museum there is now a considerable number of skulls of zebras of two species and of some subspecies of one of these; and doubtless there are other specimens in other museums.

¹ Trans. Roy. Soc. Edinburgh, vol. 45, p. 586.

² Publication 73, Carnegie Inst., Washington, vol. 2, pt. 6.

From careful measurements of these and comparison of the measurements some important results may be secured.

Therefore, from the tables presented by Nehring, Tscherski, and Salensky and from measurements made on specimens in the United States National Museum and in the American Museum of Natural History, the writer has prepared a number of tables, which follow. The measurements used are: The basilar length; the vertex length (from the middle of the occipital crest to the incisive border); frontal width (greatest width at the rear of the orbits); the cranial length (distance from the middle of the occipital crest to the middle of the line joining the rear of the orbits); the facial length (the distance from the incisive border to the middle of the orbital line just described); the distance from the lower border of the foramen magnum to the notch in the rear of the vomer; and the distance from the vomerine notch to the rear of the hard palate. The cranial length is obtained by first measuring from the midline of the occipital crest to the rear of the orbit. This distance is made the hypotenuse of a right-angled triangle whose base is half of the frontal width. The other side, representing the cranial length, is then determined mechanically and, if necessary, confirmed arithmetically. The result is believed to be more exact than that obtained by direct measurement on the surface of the skull.

The following table has been partly compiled and partly computed from one specimen measured by Tscherski, from the measurements of five horses, as given by Salensky in his work on *Equus przewalskii*, and from three specimens in the American Museum of Natural History. Only adult specimens have been considered.

Measurements of skulls of *Equus przewalskii* in millimeters, with indices.

Specimen.	Basilar length.	Vertex length.	Frontal width.	Ce- phalic index.	Cranial length.	Cranio- cephalic index.	Facial length.	Facio- cephalic index.	For. mag. to vomer.	Vomer to palate.
5218, Salensky	481	543	201	41.2	175	36.4	376	78.2	118	105
212, Salensky	472	528	202	42.8	170	36.0	364	77.1	125	110
5214, Salensky	484	538	208	42.9	172	35.5	366	75.6	117	110
5216, Salensky	495	547	209	42.2	169	34.1	377	76.2	123	109
5213, Salensky	485	542	212	43.7	173	35.6	373	76.9	119	105
512, Tscherski	440	488	188	42.6	150	34.1	335	76.1	112	100
32686, Am. Mus.	493	550	212	43.0	176	35.7	380	77.1	119	103
136, Am. Mus.	480	532	208	43.4	167	34.8	368	76.6	125	96
71, Am. Mus.	457	507	200	43.7	155	33.9	351	76.8	121	92
Averages	476	531	204	42.9	171	35.1	363	76.7	120	103

As regards the basilar length, it will be observed that the difference between that of the largest skull and the smallest one is only 55 mm., and that the difference between the greatest frontal width and the least is only 24.5 mm. As to the cephalic index, which shows the rela-

tion of the width of the skull to the basilar length, the variation forms less than 6 per cent of the mean. It will be seen, too, that the cranio-cephalic index shows relatively little variation. The greatest and the least are found in two of the skulls in the American Museum of Natural History. The variation in the length of the face, as shown by the facio-cephalic index, is less than 3.5 per cent of the mean. The position of the notch in the vomer is more subject to variation; in one case only is it nearer the foramen magnum than to the rear of the hard palate.

Salensky¹ has discussed the slight range of variation in the skull of this species.

Coming now to the zebras, the writer here presents measurements and indices of eight adult skulls of *Equus grevyi*, of eight of *Equus quagga granti*, of two of *E. quagga chapmani*, of three specimens of *E. quagga crawshayi*, of one of *E. quagga böhmi*, and of one of *E. quagga cunninghami*. All of these, now in the United States National Museum, (except Crawshay's zebra, obtained by H. C. Moore in central South Africa) were collected in British East Africa by Theodore Roosevelt, Kermit Roosevelt, E. A. Mearns, Edward Heller, and J. A. Loring. The first species considered is *Equus grevyi*.

Measurements of skulls of Equus grevyi in millimeters, with indices.

Specimens in U. S. National Museum.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
163228 ♀	545	615	218	40.0	200	36.5	422	77.4	130	145
182027 ♂	528	590	216	40.5	187	35.4	413	78.2	132	158
182063 ♂	558	615	209	37.4	190	34.0	428	76.7	134	136
163338 ♂	557	627	210	37.7	190	34.1	443	76.8	130	140
163331 ♀	556	632	213	38.3	202	36.3	437	78.6	131	141
182028 ♀	537	600	210	39.1	189	35.2	415	77.3	136	132
163334 ♀	536	600	202	37.6	191	35.6	410	76.5	128	142
182026 ♀	525	595	205	39.0	190	36.2	408	77.7	122	135
Averages.....	543	609	210	38.7	192	35.4	422	77.4	130	141

There is observed here but little variation in the length and the width of the eight skulls measured. The cephalic index varies beyond the mean not as much as 5 per cent, and the difference between the extremes only 8 per cent. The index is very low, and this horse is the most narrow-headed one known. The facio-cephalic index neither rises above nor falls below the mean more than 1.5 per cent. The cranio-cephalic index is very stable, and the facio-cephalic still more so. The vomerine notch is usually nearer the foramen magnum, as in the domestic ass.

¹ The Przevalsky Horse, Bradley and Hayes Translation, p. 28.

Measurements of skulls of *Equus quagga granti* in millimeters, with indices.

Specimens in U. S. National Museum.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
161930 ♂	440	486	185	42.0	157	35.7	335	76.1	108	100
162957 ♀	437	498	190	43.5	171	39.1	328	75.1	107	102
161929 ♂	443	510	181	41.4	180	41.5	335	77.3	113	110
162950 ♂	475	538	194	40.8	176	37.1	370	77.9	108	120
181947 ♂	447	513	183	40.9	173	38.7	345	77.2	108	113
162953 ♀	440	508	188	42.7	175	39.7	344	78.2	105	104
162239 ♀	437	498	185	42.3	158	36.1	335	76.6	107	108
162960 ♂	427	500	182	42.6	167	36.5	333	78.0	110	100
Averages.....	443	506	186	42.0	170	38.5	341	77.1	108	107

Among the eight skulls of this subspecies there is found to be a difference of 48 mm. between the longest and the shortest basilar length, and there is a difference of only 13 mm. between the greatest and the least frontal width. The cephalic index passes neither above nor below the mean more than about 3.5 per cent, and the difference between the highest and the lowest amounts to less than 6.5 per cent of the mean; the facio-cephalic index varies still less. The vomerine notch is near the median point between the foramen magnum and the hard palate.

Measurements of skulls of *Equus quagga crawshayi* in millimeters, with indices.

Specimens in U. S. National Museum.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
61744 ♂	462	525	177	38.3	165	35.7	365	79.0	108	106
38212 ♀	432	505	181	41.9	168	38.9	341	78.9	108	108
38211 ♂	471	541	195	41.4	191	40.5	364	77.3	126	101
Averages.....	441	524	184	40.5	175	38.4	357	78.4	114	105

Of the subspecies *Equus quagga crawshayi* there are in the United States National Museum only three skulls. In size, as represented by the basilar length, they are all within the limits of the skulls of Grant's zebra. The cephalic index of one specimen falls to 38.3, as low as in some skulls of Grevy's zebra, but in the others the index is nearly up to the average found in Grant's zebra. The index 38.3 falls below the average of that of Grant's zebra less than 9 per cent. The small number of specimens measured makes it impossible to determine whether or not this is an abnormal individual or whether there is great variability in this form. And attention may be here called to the fact that in these lists it is just in those cases where there are few individuals measured that there are found the greatest differences. This fact is illustrated likewise in the two following tables.

Measurements of skulls of Equus quagga chapmani in millimeters, with indices.

Specimens.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
5239, Salensky.....	448	501	202	45.1	165	36.8	344	76.8	106	109
5240, Salensky.....	452	513	184	40.7	159	35.2	356	78.7	106	112
Averages.....	450	507	193	42.9	162	36.0	350	77.7	106	111

In the case of Salensky's specimen (No. 5239) of Chapman's zebra one might reasonably suspect some error. If the measurements and indices are compared with those of *Equus hemionus*, the two sets will be found to be remarkably similar.

Measurements of skulls of Equus q. böhmi and E. q. cunninghami in millimeters, with indices.

Specimens in U. S. National Museum.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
<i>E. q. böhmi</i> , 181825...	488	560	192	39.3	194	39.7	370	77.9	127	114
<i>E. q. cunninghami</i> , 182156.....	435	500	188	43.0	166	38.2	335	77.0	109	102

If now there are determined the averages of the measurements and indices of all the specimens of Grant's, Crawshay's, Chapman's, Boehm's, and Cunningham's zebras, leaving out only the suspected specimen of Chapman's mentioned above, there are obtained the following:

Combined measurements and indices of subspecies of Equus quagga in millimeters.

	Basilar length.	Vertex length.	Frontal width.	Cephalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.
Averages.....	446	514	186	41.6	172	38.3	347	77.5

By considering the difference between the greatest and the least values shown in each of the respective columns devoted to the various subspecies and bringing them into comparison with the corresponding average it will be seen that the basilar length varies by an amount less than 14 per cent of the average; the frontal width less than 10 per cent; the facial length about 12 per cent. The cephalic index varies to the extent of 12.5 per cent of the mean. The variation of the cranio-cephalic index is greater, about 21.5 per cent. Within the subspecies *granti* it varies to the extent of 15 per cent. It seems possible that the wide range here may be due to the greater or less development of the occipital crest; not improbably the brain is considerably larger in some individuals than in others.

The elements from which the following table has been prepared are found in Nehring's and Salensky's papers.

Measurements of skulls of *Equus zebra* in millimeters, with indices.

Specimen.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
800, Nehring.....	446	504	180	40.4	161	36.1	334	74.9	100	112
1450, Nehring.....	451	520	184	40.8	163	37.2	356	78.9	113	.....
799, Nehring.....	492	555	205	41.6	191	38.8	379	77.0	130	114
5238, Salensky.....	485	555	187	38.6	188	38.7	375	77.3	119	114
111, Salensky.....	437	483	201	45.9	173	39.6	321	73.4	112	103
Averages.....	462	523	191	41.4	176	38.1	353	76.3	115	111

Among the skulls represented here there is a remarkable amount of variation, and this appears especially in the two sets of measurements furnished by Salensky. The first of these two has a skull as narrow as the average of those of *E. grevyi*, while the second skull is as wide as that of some of the asses. Indeed, this second skull resembles closely the last one in the list of those of *E. asinus*. In case this skull should be left out of the estimate as being that of an unusually developed beast or as possibly not of this species, the cephalic index would be 40.4, and the variation between the lowest and the highest value would be less than 7.4 per cent of the mean. In other respects the species, as represented, would show close conformity to its type.

Consideration will now be given to some of the forms which pass under the name of asses. *Equus asinus* is included, although a domesticated animal.

Measurements of skulls of *Equus hemionus* in millimeters, with indices.

Specimens.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
513, Salensky.....	427	487	197	46.1	160	37.5	338	79.1	95	122
1075, Salensky.....	445	499	197	44.2	163	36.6	343	77.1	105	112
516, Salensky.....	436	498	198	45.4	155	35.5	341	78.2	105	113
515, Salensky.....	465	529	202	43.4	166	35.7	374	80.4	116	110
511, Salensky.....	463	529	204	44.1	167	36.1	368	79.5	106	120
217, Salensky.....	468	525	209	44.6	167	35.7	361	77.1	115	103
224, Salensky.....	469	520	196	41.8	171	36.4	358	76.3	111	128
515, Tscherski.....	472	522	201	42.7	163	34.5	364	75.9	115	110
Averages.....	456	514	201	44.1	164	36.0	355	77.9	109	115

A study of this table shows that there is a difference of 45 mm. between the greatest basilar length and the least. This difference equals less than 10 per cent of the average length. Between the widest and the narrowest skull there is a difference of only 13 mm. The cephalic index presents an extreme variation of about 9 per cent of the average. The cranio-cephalic index shows a variation amounting to 8.3 per cent of the mean, while the facio-cephalic index varies to an amount equaling 5.8 per cent.

The following measurements and indices have been obtained from data furnished by Nehring, Tscherski, Salensky, and from a skull which is in the United States National Museum, and which was obtained in southern Kashmir.

Measurements of skulls of Equus kiang in millimeters, with indices.

Specimens.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
3874, Salensky.....	474	540	218	46.0	166	35.0	374	78.9	110	113
5227, Salensky.....	449	508	202	45.0	167	35.0	349	77.1	128	107
3874, Tscherski.....	482	544	219	45.4	169	35.1	377	78.2	111	127
30, Nehring.....	470	525	209	44.5	169	35.9	359	76.4	113	117
49493, U. S. Nat. Mus.....	450	500	205	45.5	165	36.6	345	76.7	111	118
Averages.....	465	523	211	45.3	167	35.5	361	77.5	115	116

We have here a species which conforms in many respects more closely to an average than does *Equus hemionus*. The basilar length varies in the five individuals only 32 mm., which equals not quite 7 per cent of the mean. The cephalic index shows a range of variation equaling only 3.3 per cent of the average. The cranio-cephalic index presents a range of only 4.5 per cent, and the facio-cephalic index one of only 3.3 per cent.

The following table is based on measurements of eleven skulls of the domestic ass. These are taken mostly from Nehring, Tscherski, and Salensky. Three skulls in the American Museum of Natural History furnished additional data.

Measurements of skulls of Equus asinus in millimeters, with indices.

Specimens.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
1, Nehring.....	353	407	170	48.1	151	42.8	260	73.6	80	90
2, Nehring.....	360	410	176	48.8	144	40.0	270	75.0	88	95
3, Nehring.....	360	415	181	50.3	142	39.4	281	78.1	91	93
5, Nehring.....	370	422	191	51.6	153	41.4	270	73.0	86	97
1136, Tscherski.....	365	408	166	45.4	145	39.7	265	72.6	87	95
1142, Tscherski.....	370	424	173	46.7	155	41.9	271	73.3	86	98
114, Tscherski.....	401	445	190	47.4	162	40.4	283	70.6	99	107
1136, Salensky.....	362	410	167	46.1	141	38.9	264	72.5	87	93
1142, Salensky.....	365	424	176	48.2	153	41.9	274	75.1	86	96
107, Amer. Museum..	390	442	182	46.7	158	40.5	289	74.1	95	107
15675, Am. Museum..	425	485	200	47.1	171	40.2	318	74.8	98	112
Averages.....	375	427	175	47.8	152	40.6	277	73.9	89	98

Among the eleven individuals here represented there is a variation of only 72 mm. in the basilar length and 34 mm. in the frontal width. A specimen measured by Nehring had, however, a basilar length of 504 mm. A consideration of the cephalic index shows a greater range of variation, amounting to nearly 13 per cent of the mean. The extremes of variation in the cranio-cephalic and the facio-cephalic

indices amount to about 10 per cent of the mean. The face is on an average considerably shorter than that of any others of the Equidae here considered; but cases occur in which it is about as long as that of any of the others. This shows that it is not safe to trust wholly to any single character in determining species. The vomerine notch is nearer the foramen magnum than to the palate in the specimen considered, but the difference is sometimes small. In consideration of the fact that those species which are represented by a considerable number of skulls usually show much less variation than do those of the domestic ass, is it not allowable to suppose that the wide variations of the latter are due to domestication?

The materials which have been used in constructing the following table have been found in the schedule of measurements and indices of sixty skulls of Equidae furnished by Nehring in the work already referred to. Besides skulls referred to *Equus caballus*, Nehring considered the asses and the zebras. The skulls of his list are arranged in the order of their basilar length, beginning with the lowest. From this list the present writer has selected eight skulls near the beginning and eight from near the end of it, thus getting a group of small horses and another of large ones.

Measurements in millimeters and indices of domestic horses.

Numbers of specimens in Nehring's list.	Basilar length.	Vertex length.	Frontal width.	Ce-phalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
13.....	426	464	190	44.3	151	35.5	320	75.1	111	92
14.....	438	490	201	45.9	162	36.9	327	74.6	119	89
15.....	438	492	201	45.9	158	36.1	342	78.1	107	97
16.....	443	490	193	43.5	162	36.6	333	75.2	111	99
18.....	448	492	202	45.1	163	36.4	357	79.8	119	93
20.....	450	490	189	42.0	158	35.1	343	76.2	109	100
21.....	450	494	192	42.7	159	35.3	337	74.9	114	95
23.....	452	500	201	44.5	162	35.8	337	74.5	109	100
49.....	536	584	222	41.4	190	35.4	396	73.9	142	111
50.....	542	569	222	41.0	182	33.6	391	72.1	142	114
51.....	546	587	216	39.5	168	30.8	419	76.7	136	120
52.....	550	586	214	38.9	176	32.0	410	74.5	143	117
55.....	558	605	231	41.4	182	32.6	419	75.1	139	116
56.....	571	615	236	41.3	183	32.1	414	72.5	141	119
57.....	574	623	238	41.4	191	33.3	434	75.6	145	122
58.....	585	628	255	43.6	201	34.4	423	72.3	155	121
Averages.....	500	544	213	42.7	172	34.5	375	75.1	128	107

If we now accept all these skulls as belonging to a single species, *Equus caballus*, we have one which exhibits a very wide range in size and structure. The difference between the basilar length of the smallest and that of the largest skull amounts to 159 mm., nearly 32 per cent of the mean length. The difference between the least frontal width and the greatest is 66 mm., more than 30 per cent of the mean frontal width. The cranial length has a range of 50 mm., which is 29 per cent of the mean length; the facial length, a range

of 114 mm., which amounts to somewhat more than 30 per cent of the average length.

Although these things are true, the indices might nevertheless be relatively stable, but we do not find them to be so. The cephalic index varies to an amount somewhat greater than 16 per cent of the mean; the craniocephalic index more than 17 per cent; and the faciocephalic index more than 11 per cent. No such differences appear in the wild species. It may be contended that these differences are due to domestication; and we do find considerable, but more narrowly limited, variations in the domestic ass. However, there are evidences that similar differences existed among the European horses of the latter half of the Pleistocene; and on these differences has been based the hypothesis that there existed among the Pleistocene a number of races or subspecies of *Equus caballus*.

If now we consider those eight horses in the above list which are placed above the horizontal line we find the following averages:

Averages of measurements in millimeters and indices of small domestic horses.

	Basilar length.	Vertex length.	Frontal width.	Ce- phalic index.	Cranial length.	Cranio- cephalic index.	Facial length.	Facio- cephalic index.	For. mag. to vomer.	Vomer to palate.
Average.....	443	489	196	44.2	159	36.0	337	76.1	112	96

From this table and that from which these averages are obtained it is seen that the cephalic index is high, indicating a broad face. It is seen, too, that the difference between the highest and the lowest expressions amounts to less than 9 per cent of the averages; that the cranio-cephalic index has a range of variation of only 5 per cent of the average, and that the facio-cephalic index has a range of only 7 per cent of the mean.

Considering the eight examples which occupy the lower half of the table on page 559, we find as follows:

Averages of measurements in millimeters and indices of large domestic horses.

	Basilar length.	Vertex length.	Frontal width.	Ce- phalic index.	Cranial length.	Cranio- cephalic index.	Facial length.	Facio- cephalic index.	For. mag. to vomer.	Vomer to palate.
Averages.....	558	600	229	41.1	184	33.0	413	74.1	143	118

From this table we learn that the cephalic index is rather low, the average, 41.1, being slightly below the dividing line which Nehring drew between the narrow-faced and the broad-faced horses (240 according to his method=41.6 according to the method employed here). The fluctuation of this index amounts to 11.4 per cent in

the eight specimens measured. The cranio-cephalic index has an average of 33 and a fluctuation of 4.6, which is equal to 14 per cent of the mean; while the facio-cephalic index has a variation of only 6.2 per cent of the mean. It is somewhat remarkable that the cranio-cephalic index varies so little in the broad-skulled group and so much in the narrow-skulled horses. Now, each of these two groups has all the characteristics of structure and proportion of a well-defined species, such as the Przevalsky horse, Grevy's zebra, and the chigetai. There appears to be no necessary relation between a short skull and a wide forehead; and therefore it can not be said that the results are due to having selected the shorter skulled specimens. The eight skulls of Grant's zebra have the average of the basilar length exactly the same as that of the eight small domestic horses, but the frontal width is considerably less and the cranio-cephalic index, too, is less. We need not, therefore, believe that the peculiarities of the two groups is due merely to size; nor can we suppose that the two groups are pure strains. We know that in each there is some admixture of the one with the other; and there may be some mingling of possibly a third constituent.

The writer believes, therefore, that it will be necessary to recognize at least two distinct species among the progenitors of our domestic horses. An objection to this view may be found in the fact that these have bred and do breed freely together; but this objection will apply quite as well against our regarding *Equus przewalskii* as a distinct species. One of the two supposed species is represented in our time by the large narrow-faced horses, such as form the second portion of the table on page 559; the other is represented by the pony-like broad-faced horses, especially the Celtic pony and the fjord horses of Norway. It has been already stated on page 552 that Ewart in his work in the Transactions of the Edinburgh Royal Society has presented certain measurements of a Celtic pony and that estimates showed that its basilar length was close to 437 mm. Accepting this and other measurements given by Ewart, likewise those of a Celtic pony from the Loffoden Islands furnished by Stejneger, there is obtained the following table:

Measurements in millimeters and indices of two Celtic ponies.

Specimen.	Basilar length.	Vertex length.	Frontal width.	Cephalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.
Ewart's.....	437	485	192	43.7	170	36.7	333	76.2
Stejneger's.....	456		210	46.3	155	34.0	336	73.7

The specimen measured by Stejneger has an extraordinarily broad face. It is broader, in fact, than either of the skulls of Ewart's two

"Forest horses."¹ It will be observed, too, that the Loffoden specimen has low cranio-cephalic and facio-cephalic indices. Inasmuch as Stejneger regards the tarpan of southern Russia as being co-specific with the Celtic pony, it will be well to include here the data regarding the skulls of two recorded specimens. The elements of the following table are taken from Tscherski's table:

Measurements in millimeters and indices of skulls of the tarpan.

Specimens.	Basilar length.	Vertex length.	Frontal width.	Cephalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
Chersonese.....	470	512	206	43.6	168	35.7	347	73.8	128	89
Crimean.....	470.5	520	203	43.1	172	36.5	346	73.5	122	95.5

The measurements and indices of these two specimens are remarkably similar. In size, as shown by the basilar length, they are larger than either of the two ponies recorded in the table just preceding this one. They are also larger than any of the eight small horses found in the table on page 559. Nevertheless, they are not much larger, and are far from having the size of the large horses. In breadth of face they resemble the small horses and Ewart's Celtic pony. In the facio-cephalic index they resemble the Loffoden pony, as well as some of the large narrow-faced group. The chances are that their predecessors had mingled somewhat with the large narrow-faced horses.

To the broad-faced species of the Pleistocene would be assigned horse No. 25 of Nehring's list, found in a peat bog in northern Germany and figured by Nehring on his plate 7. From his measurements the following results are obtained:

Nehring's Tribsces horse.

Basilar length.	Vertex length.	Frontal width.	Cephalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
455	<i>mm.</i> 500	<i>mm.</i> 204	44.8	<i>mm.</i> 163	35.8	<i>mm.</i> 333	73.2	<i>mm.</i> 110	<i>mm.</i> 108

It will be seen that these measurements and indices agree well with those of the smaller domestic horses, except that the size is somewhat greater and that the face is rather shorter than usual on the latter. In this respect it agrees with the tarpan just described.

From the fossil horse, described by Nehring from Remagen and illustrated on his plate 5, the following measurements and indices are obtained:

¹ Trans. Roy. Soc. Edinburgh, vol. 4, p. 586.

Fossil horse from Remagen.

Basilar length.	Vertex length.	Frontal width.	Cephalic index.	Cranial length.	Cranio-cephalic index.	Facial length.	Facio-cephalic index.	For. mag. to vomer.	Vomer to palate.
528	mm. 562	mm. 212?	40.1	mm. 180	34.1	mm. 388	73.5	mm. 139	mm. 112

A comparison of the estimates printed here with those of the table of large domestic horses shows that the Remagen horse agrees in all essential respects with the former. This was the conclusion reached by Nehring himself.

It is believed by many that the late Pleistocene ancestors of Przevalsky's horse took part as one of the constituents of *Equus caballus*. A comparison of the table devoted to this species with that dealing with the domestic horses shows that Przevalsky's horse is intermediate in size between the large ones and the small ones; that the cephalic index is intermediate, but nearer the large horses; that the cranio-cephalic index is nearer that of the small horses; and that the facio-cephalic index has an average above both groups. There appears to be no reason whatever for supposing that *E. przewalskii* had anything to do with either of them.

One might suppose, however, that *E. przewalskii* formed an important element in horses of intermediate size. Ewart, for various reasons, believes that this species, or something like it, enters into composition of all the long-faced horses; but the tables here presented show that the large, heavy, apparently long-faced horses have really the facio-cephalic index lower than do the smaller and broad-faced horses. Duerst concludes that the Przevalsky horse stands in close relationship with certain European Pleistocene horses. Salensky thought it might possibly have an affinity to the pony; and Noack, as noted by Ewart, held this view strongly. To these views there are some objections.

1. The presence of *E. przewalskii* in Europe has not been proved. There may have been another species in Europe in the Pleistocene which resembled it, but which became extinct.

2. The inclusion of the Przevalsky horse in *Equus caballus* would compel the admission that in Europe there were, during the late Pleistocene, three distinct species of horses which could be made to breed freely together. It is difficult to believe that two species could be made to interbreed; it is improbable that three could be induced to do so.

3. In case Przevalsky's horse had entered to any considerable extent into the formation of our domestic horses, we might naturally expect that there would be displayed more conspicuously in some of the domestic races those external characters which Salensky has

enumerated, especially the upright mane and the peculiarly haired tail.

It is thought well to present a brief conspectus of the more important average measurements and indices which have been obtained up to this point in the conclusion.

Average measurements in millimeters and indices of Equids considered.

Species.	Basilar length.	Cephalic index.	Cranio-ceph. index.	Facio-ceph. index.	For. mag. to vomer.	Vomer to palate.
<i>E. przewalskii</i>	476	42.9	35.1	76.7	120	103
<i>E. grevyi</i>	543	38.7	35.4	77.4	130	141
<i>E. granti</i>	443	42.0	38.5	77.1	108	107
<i>E. zebra</i>	462	41.4	38.1	76.3	115	111
<i>E. hemionus</i>	456	41.1	36.0	77.9	109	115
<i>E. kiang</i>	465	45.3	35.5	77.5	115	116
<i>E. asinus</i>	375	47.8	40.6	73.9	89	98
8 small horses.....	443	44.2	36.0	76.1	112	96
8 large horses.....	558	41.1	33.0	74.1	143	118

It appears to be a common idea that the small, broad-faced horses are likewise short-faced, and that the large horses are long-faced as well as narrow-faced. Relatively the small horses which have been dealt with on page 559 have a greater cranio-cephalic index than the eight large ones, but they have likewise a larger facio-cephalic index. It follows almost of necessity from that table that the vertex length of the small horses is, as measured by the basilar length, greater than in the large horses. In the following table the vertex-length index has been obtained for each of the sixteen skulls used in the table referred to:

Indices of vertex length of domestic horses.

Small horses.		Large horses.	
Number in Nehring's list.	Index.	Number in Nehring's list.	Index.
13	108.9	49	108.9
14	111.9	50	105.0
15	112.3	51	107.5
16	110.6	52	106.5
18	109.8	55	103.4
20	108.9	56	107.7
21	109.8	57	108.5
23	110.6	58	107.4
Average.....	110.3	Average.....	107.5

It may seem that we have wandered away from the consideration of the value of craniometrical measurements for the determination of species of horses and their relationships to one another. We may be really in a better position to aid in solving the problems. The conclusions reached at present are as follows:

1. Measurements and indices are of great value in distinguishing certain species of horses from certain others.

The skull of the domestic ass may in the great majority of cases be distinguished from that of all other equids. Grevy's zebra possesses craniometrical characters which set it off quite decidedly from other horses and zebras. The writer believes that measurements and the indices derived from them show plainly that two species are mingled in different proportions in our different races of domestic horses.

2. Not all species can be distinguished by craniometrical methods. It is reasonable to suppose that two or more species might have skulls and skeletons of practically the same size and proportions and yet differ greatly in external characters and perhaps in details of structure of the teeth.

3. In cases where only single skulls of two or more supposed species are at our disposition, as in the case of most fossil horses, the measurements and indices must be employed with circumspection. The measurements of one skull may differ considerably from those of another and yet both belong to the same species, for they may present the extremes which arise from individual variation. Not too much dependence should be placed in any one measurement or in any single index. All ought to be considered, and all other characters ought to be considered in coming to a conclusion.

4. It is difficult to say which measurements and which indices are of the most importance. The basilar length, the cranial length, the facial length, the width at the rear of the orbits, and the indices derived from them are of prime importance. In the application of these to special cases sometimes one index may be of special value; in other cases another index may be decisive.

5. The value of still other indices than those considered in this paper, such as that expressing the angle included between the axis of the cranium and the axis of the face, the index showing the relation of the length of the tooth line to the basilar length, the index expressing the relation of the protocone to the length or width of the tooth, ought to be tested on the Przevalsky horse, the zebras, the chigetai, the kiang, and the domestic ass.

4. ON SOME RESULTS OBTAINED BY W. SOERGEL.

W. Soergel has written an interesting paper entitled *Die Pferde aus der Schotterterrasse von Steinheim a. d. Murr*.¹ This author has reached certain results which he regards as of great value in determining the phylogenetic position of the various horses of the Pleistocene of Europe (p. 743) and the age of the deposits in which horse teeth may occur (p. 746). While Soergel's results are applied by him only to the horses of the Pleistocene of Europe, they might be supposed to be applicable to those of North America likewise.

¹ Neues Jahrb. Min., etc., *Beilage*, vol. 32, 1911, pp. 740-761, pls. 33, 35.

On page 743 Soergel writes that in all diluvial forms of horses the relative length of the upper premolar series is the same, the variations being very small and irregular. The present writer has made measurements and calculations to determine what is the ratio of the upper premolars to the whole premolar-molar series (regarded as 100) in the horses named below.

Ratio of upper premolars to premolar-molar series.

<i>Equus francisci</i> , type-----	54.8
<i>E. hatcheri</i> , type-----	51.3
<i>E. laurentius</i> , type-----	54.4
<i>E. niobrarensis</i> , type-----	54.2
<i>E. scotti</i> , 10628 Amer. Mus.-----	55.0
<i>E. caballus</i> , 174960 Nat. Mus.-----	53.2
<i>E. caballus</i> , 172454 Nat. Mus., Arabian-----	56.6
<i>E. hemionus</i> , 49493 Nat. Mus.-----	54.0

All of the fossil species mentioned above belong certainly to the early Pleistocene, *E. niobrarensis* and *E. hatcheri* were obtained in the same quarry. Nevertheless, there is a good deal of variation in the ratios. *E. caballus*, No. 174960, is a large horse with basilar length of 610 mm. and therefore of the occidental type; the ratio here falls below that of *E. niobrarensis*, of the early Pleistocene, in all probability of the first interglacial stage, and still more below the little horse *E. francisci*. Above all stands the ratio in the last horse mentioned, the so-called Arabian.

Soergel makes the statement (p. 743) that in the lower jaw the relative length of the premolars is greater in the phylogenetically older forms than in the more recent. He shows that in the case of *E. stenonis* of the late Pliocene the ratio of the premolar series to the whole tooth-line is 56.0; in *E. süssenbornensis*, of the first interglacial stage, 53.1; in *E. mosbachensis*, also of the first interglacial, 52.6 to 51.7; *E. germanicus?* from Taubach of the third interglacial, 52.1; and *E. germanicus* from the loess, 48.6 to 50.5.

From the specimens from which the present writer obtained the ratios for the upper teeth the following ratios have been determined for the lower cheek-teeth, *E. francisci* being necessarily omitted:

<i>Equus hatcheri</i> -----	52.1
<i>E. laurentius</i> -----	50.0
<i>E. niobrarensis</i> -----	53.0
<i>E. scotti</i> -----	52.2
<i>E. caballus</i> -----	51.9
<i>E. caballus</i> -----	53.0
<i>E. hemionus</i> -----	51.3

There appear in the above table no evidences that the lower premolar series has become shorter in the horses since the beginning of the Pleistocene. Furthermore, if we go back to *Mesohippus bairdi*,

of the Oligocene, we shall find that the premolar series formed only about 48 per cent of the length of the lower premolar-molar series, omitting the minute front premolar (pm_1). The present writer is of the opinion that it would be difficult to prove the proposition that in the horses in general the lower premolar series has become relatively shorter in the more recent than it was in the earlier forms. It would be quite as difficult to prove that the “lobus tertius” of the hindmost molar has increased in length as compared with the whole length of the molar mentioned.

Soergel described and figured a quite complete lower jaw of a horse which had been found at Steinheim. This author has measured the height of the horizontal ramus of his specimen at seven places, as in the table below, and has given the heights in hundredths of the length of the lower row of cheek teeth. For purposes of comparison he has done the same with three other fossil horses of his region and with a specimen of the domestic horse. From his comparisons he has concluded that the height of the lower ramus in the older forms of horses was greater relatively to the tooth row than in the more recent forms; that the reduction in height from the rear forward was more gradual, and that consequently in the older forms this part of the jaw was heavier than in the later horses. To test the applicability of these conclusions to the American Pleistocene horses the present writer has prepared the following table, in which the jaws are measured after Soergel’s method. Soergel’s measurements of *E. caballus* are included. The horse which furnishes the measurements of the fourth column is the one in the United States National Museum whose basilar length is 610 mm.

Dimensions in jaws in hundredths of the length of the tooth line.

Dimensions taken.	<i>E. nio- brarensis.</i>	<i>E. hatch- eri.</i>	<i>E. cabal- lus</i> of Soergel.	<i>E. cabal- lus</i> , U. S. Nat. Mus.	<i>E. cabal- lus</i> Arab.
Height behind m_3	71.2	68.1	59.6	65.7	67.2
Height between m_3 and m_2	57.4	57.4	47.6	55.4	53.3
Height between m_2 and m_1	53.0	54.2	44.5	51.1	47.8
Height between m_1 and pm_4	52.4	52.6	41.5	48.9	45.4
Height between pm_4 and pm_3	49.1	50.0	37.8	47.3	43.0
Height between pm_3 and pm_2	44.2	45.7	34.7	41.8	39.4
Height in front of pm_2	38.0	38.3	26.9	37.5	30.3

If now we find in each of the specimens here studied the ratio between the uppermost number in each case and the lowermost we shall have an expression showing the amount of descent in the jaw in going from the rear of the hindmost molar to the front of the anterior premolar. These ratios given in order are: 53.5 for *E. nio-brarensis*; 56.2 for *E. hatcheri*; 45.1 for Soergel’s *E. caballus*; 57.1 for the large *E. caballus*; and 45.1 for the Arabian. From this it appears that the large specimen of *E. caballus* has a lower jaw which

is relatively higher in front than in any of the other specimens, although as a whole it is a less heavy jaw. This large jaw presents a ratio quite different from that of Soergel's specimen, while the jaw of the Arabian presents the same ratio as Soergel's. It needs to be noted that the numbers in the last two columns of the table given above are quite different from those in the third column; and, besides, are somewhat different from each other. The conclusion which one must reach is that there is among the domestic horses and probably all others more or less variability in the lower jaw, as there is in all other structures. Even in any unmixed species the lower jaw must be subject to great variations due to the state of development of the teeth. The author regrets that he has not the time to test on the zebras in the National Museum Soergel's indices and many others which have been proposed.

5. ON THE LIMB BONES OF CERTAIN FOSSIL HORSES.

In the year 1886 John Bell Hatcher made a collection of vertebrate fossils in the region south of the present town of Hay Springs, Nebraska, for Prof. O. C. Marsh, then connected with the United States Geological Survey. From Mr. J. W. Gidley the writer learns that the exact locality is on the south side of the Niobrara River, about 15 miles south of Hay Springs; and it is evidently in township 29 north and 47 west. The fossils occurred in a very restricted area and in a deposit of loose sand. These fossils are now in the National Museum. Dr. W. D. Matthew has given a list of the species of vertebrates found in that neighborhood, probably in the same quarry. Besides extinct horses, the list includes *Myiodon*, *Castoroides*, *Capromeryx*, and three species of camels.¹

In the collection at the National Museum there have been found packed together in the same box a right fore and a right hind leg complete with corresponding parts of the shoulder and pelvic girdles. They are regarded as having all belonged to the same individual. The fore leg has the number 7863; the hind leg the number of 7924. These were not accompanied in the package by any skulls or teeth, and it is therefore not possible to determine exactly to which one of the several species of horses which lived in that region they belonged. They are here referred provisionally to *Equus laurentius*, the smallest known horse of that region. It is proposed to describe these bones and to make comparisons of them with corresponding bones of an Arabian horse in the National Museum and with some bones of other horses found in the same locality in Nebraska.

In the first, third, fifth, and seventh columns are given the absolute measurements, while in the second, fourth, sixth, and eighth columns are presented the percentages which are obtained by com-

¹ Bull. Amer. Mus. Nat. Hist., vol. 16, p. 317.

parison of the length of some of the bones, called 100, with certain of the transverse measurements.

Measurements, in millimeters, of bones of horses, with indices.

	Arabian.		<i>Equus laur-</i> <i>rentius.</i>		No. 7857.		No. 7923.	
	1	2	3	4	5	6	7	8
Scapula, length from front of glenoid cavity to upper border, along the spine.....	358	-----	325	-----	-----	-----	320	-----
Width near upper end, greatest.....	175	-----	175	-----	-----	-----	64	-----
Width of neck, where least.....	68	-----	64	-----	-----	-----	90	-----
Greatest width at lower end.....	98	-----	88	-----	-----	-----	-----	-----
Fore-and-aft diameter of glenoid cavity.....	61	-----	56	-----	-----	-----	-----	-----
Humerus, total length.....	317	-----	270	-----	292	-----	310±	-----
Length from head to inner side of distal end.....	300	100	248	100	282	100	292	100
Greatest width at upper end.....	123	41	90	36.3	90	31.9	100	34.2
Side-to-side diameter at middle of length.....	37	12.3	35	13.3	35	12.4	40	13.7
Width across lower articular surface.....	80	26.7	73	29.4	78	27.6	83	28.4
Ulna, total length to articulation with cuneiform.....	443	-----	372	-----	418	-----	413	-----
Radius, length from upper articular surface to the lower, on the outer border of the bone.....	352	100	290	100	328	100	325	100
Greatest width at upper end.....	85	24.2	79	27.2	87	26.5	93	28.5
Fore-and-aft diameter at middle of length.....	29	8.2	30	9.8	29	8.8	33	10.1
Side-to-side diameter at middle of length.....	40	11.3	41	14.1	43	13.1	45	13.8
Greatest width near lower end.....	80	22.7	69	23.8	74	22.5	81	24.8
Greatest width of distal articular surface.....	67	19	58	20	65	19.8	71	21.8
Median metacarpal, length on outer border.....	240	100	213	100	222	100	241	100
Side-to-side diameter of upper articular surface.....	54	22.5	50	23.4	52	23.4	55	22.8
Fore-and-aft diameter at middle of length.....	29	11.7	27	12.6	29	13.1	32	13.2
Side-to-side diameter at middle of length.....	33	12.1	34	15.9	35.5	16	40	16.6
Side-to-side diameter of distal articular surface.....	53	22.1	47	22	52	23.4	53	22
First phalange, length along outer border.....	83	100	76	100	79	100	87	100
Greatest width across upper end.....	56	65.9	54	71	62	78.4	61	70.1
Side-to-side diameter at middle of length.....	35	41.2	36	47.3	34	43	40	46
Width of lower articular surface.....	47	55.2	43	56.6	47	59.5	52	59.7
Second phalange, length on outer border.....	35	100	33	100	36	100	41	100
Width across upper end.....	55	157.1	44	133	55	152.8	59	144
Width at middle of length.....	47	134.2	41	124	46	127.7	50	122
Width across lower articular surface.....	54	154.3	43	130.3	51	141.7	53	129.2
Third phalange, length along front face.....	58	100	55	100	53±	100	55	134.1
Greatest width.....	84	144.8	68	123.6	76	143.4	77	187.7
Pelvis, length from front of ilium to rear of ischium.....	445	-----	400	-----	-----	-----	-----	-----
Greatest width near front of ilium, on curve.....	260	-----	252	-----	-----	-----	-----	-----
From front of ilium to front of acetabulum.....	265	-----	230	-----	-----	-----	-----	-----
Greatest width of pelvis.....	467	-----	-----	-----	-----	-----	-----	-----
Width of pelvis at front of acetabulum.....	240	-----	-----	-----	-----	-----	-----	-----
Distance across ischia at rear.....	233	-----	-----	-----	-----	-----	-----	-----
Diameter of acetabulum.....	65	-----	60	-----	-----	-----	-----	-----
Femur, total length.....	425	-----	378	-----	-----	-----	-----	-----
Length from head to internal condyle.....	380	100	338	100	-----	-----	-----	-----
Side-to-side diameter through head and great trochanter.....	120	31.6	116	34.3	-----	-----	-----	-----
Side-to-side diameter at middle of length.....	41	10.8	41	12.1	-----	-----	-----	-----
Greatest width across lower end.....	100	26.3	93	27.5	-----	-----	-----	-----
Patella, length.....	74	-----	65	-----	-----	-----	-----	-----
Width.....	74	-----	66	-----	-----	-----	-----	-----
Tibia, length from upper articular surface to distal end, outside.....	345	100	292	100	-----	-----	-----	-----
Width of upper end.....	102	29.5	94	32.2	-----	-----	-----	-----
Fore-and-aft diameter at middle of length.....	36	10.4	38	13	-----	-----	-----	-----
Side-to-side diameter at middle of length.....	40	11.6	45	15.4	-----	-----	-----	-----
Greatest width at lower end.....	80	23.2	72	24.6	-----	-----	-----	-----
Astragalus, length of longest diagonal across upper articular surfaces.....	80	-----	75	-----	-----	-----	-----	-----
Width across distal articular surface.....	56	-----	50	-----	-----	-----	-----	-----
Calcaneum, greatest length.....	119	-----	108	-----	-----	-----	-----	-----
Depth of tuber calcis at middle of length.....	44	-----	44	-----	-----	-----	-----	-----
Median metatarsal, length on outer face.....	290	100	263	100	-----	-----	-----	-----
Width across upper articular surface.....	53	18.3	46	17.5	-----	-----	-----	-----
Fore-and-aft diameter at middle of length.....	33	11.3	34	12.9	-----	-----	-----	-----
Side-to-side diameter at middle of length.....	33	11.3	31	11.7	-----	-----	-----	-----
Width of lower articular surface.....	53	18.3	47	17.8	-----	-----	-----	-----
First phalange, length on outer border.....	81	100	71	100	-----	-----	-----	-----
Greatest width across upper end.....	58	71.5	51	71.8	-----	-----	-----	-----
Width across middle of length.....	33	40.7	31	43.6	-----	-----	-----	-----
Width across lower articular surface.....	45	55.5	38	53.5	-----	-----	-----	-----
Second phalange, length on outer border.....	36	100	35	100	-----	-----	-----	-----
Width across upper end.....	55	152.7	45	128.6	-----	-----	-----	-----
Width at middle of length.....	46	127.7	39	111.4	-----	-----	-----	-----
Width across lower articular surface.....	51	141.6	41	117.1	-----	-----	-----	-----
Hoof phalange, length along front face.....	57	100	53	100	-----	-----	-----	-----
Greatest width.....	78	136.8	65	122.6	-----	-----	-----	-----

It is proposed now to determine the length of some of the principal bones here referred provisionally to *Equus laurentius* relative to the corresponding ones of the Arabian horse here measured. In each case the bone of the latter horse is regarded as having the value 100.

Relative measurements of bones of Arabian horse and E. laurentius?

Bones.	Arabian.	<i>E. laurentius?</i>
Scapula.....	100	91.0
Humerus.....	100	82.7
Radius.....	100	82.4
Metacarpal.....	100	88.7
First phalange.....	100	91.6
Second phalange.....	100	94.3
Femur.....	100	88.9
Tibia.....	100	84.3
Metatarsal 3.....	100	90.7
First phalange.....	100	87.6

From the above table it is seen that the larger bones of the hinder limb of the supposed *E. laurentius*, the femur, tibia, and third metatarsal, as compared with those of the Arabian horse, are longer than the corresponding bones of the foreleg; and that the metatarsal is most elongated of all. The distal bones, too, the metacarpal, metatarsal, and first phalanges are seen to have relatively greater length than the proximal bones.

If the lengths of the various bones of the fore limbs of the two species be added together, omitting the scapula and ulna and including 42 mm. for the length of the carpus of the Arabian and 37 mm. for that of *E. laurentius?*, we shall have for the length of the foreleg of the Arabian horse 1,110 mm.; for that of *E. laurentius?* 952 mm. The latter is 85.7 per cent of the former. The height of the Arabian horse is stated by its former owner, the late Mr. Homer Davenport, to have been 14.2 hands. *E. laurentius?* was, therefore, probably close to 12.6 hands high, or 4 feet 2½ inches, or 1,284 mm.

By allowing 86 mm. for the length of the tarsus of the Arabian horse and 75 mm. for that of *E. laurentius?* there is obtained as the partial length of the hinder leg of the former 1,275 mm. and for that of the latter 1,130 mm. The latter forms 88.6 per cent of the former. This indicates that the ratio of the length of the hind leg of *E. laurentius?* to that of the Arabian horse was greater than in the case of the foreleg.

In the Arabian horse the length of the foreleg is equal to 87 per cent of the length of the hind leg; in *E. laurentius?* the corresponding ratio drops to 84.2.

It can not be doubted that the owner of the two limbs here provisionally associated with *E. laurentius* was a horse considerably smaller than the Arabian with which it is here compared, himself

not a large horse, and that this horse possessed a more heavily built skeleton than the Arabian had.

It may be profitable to institute a comparison between the fore limb of the Arabian horse and a fore limb numbered 7857 in the National Museum. It was found by Hatcher in the same quarry where were found the bones just described. From an examination of the table given on page 569 we gain the following results regarding the various bones of the Arabian as having the value of 100.

Relative measurements of bones of fore leg of Arabian horse and of the fossil No. 7857.

Bones compared.	Arabian.	No. 7857.
Humerus.....	100	94
Radius.....	100	93.2
Metacarpal 3.....	100	92.5
First phalange.....	100	95.2
Second phalange.....	100	102.8

The horse No. 7857, as indicated by the bones of the fore leg, was larger than the supposed *E. laurentius*, but yet smaller than the Arabian. By adding the lengths of the humerus, the radius, the third metacarpal, and the first phalange of each of the two horses there is obtained for the leg of the Arabian 975 mm. and for that of No. 7857, 911 mm. The latter forms 93.4 per cent of the former. This may be fairly taken as representing the relative lengths of the two legs and the relative heights of the two horses. The latter seems to have had a height of 13.25 hands, 53 inches, 1,347 mm.

The fore leg, which has the number 7923, found in the same quarry as the bones referred to *E. laurentius* and those having the number 7857, has a size not greatly different from that of the last one mentioned. The following table shows the results of a comparison of the length of the principal bones with those of the Arabian, those of the latter being regarded as having the value of 100.

Relative measurements of bones of Arabian horse and of a fossil horse.

Bones.	Arabian.	No. 7923.
Humerus.....	100	97.3
Radius.....	100	92.3
Metacarpal.....	100	100.0
First phalange.....	100	104.8
Second phalange.....	100	117.1

A comparison of the table just given with the one preceding it will show that the horse represented by the bones numbered 7923 belonged to a larger horse than those numbered 7857; the height was about 13.8 hands, 55.4 inches, 1,409 mm. It may be observed,

too, that the metacarpal and the phalanges were, as measured by those of the Arab, longer than those of No. 7857.

For convenience in making comparisons a table is presented which combines the two immediately preceding tables with a part of the one on page 570.

Relative measurements of bones of Arabian horse, E. laurentius?, No. 7857, and No. 7923.

Bones.	Arabian.	<i>E. laurentius</i> .	No. 7857.	No. 7923.
Humerus.....	100	82.7	94.0	97.3
Radius.....	100	82.4	93.2	92.3
Metacarpal.....	100	88.7	92.5	100.0
First phalange.....	100	91.6	95.2	104.8
Second phalange.....	100	94.3	102.8	117.1

A direct comparison will now be made between the fore leg referred to *E. laurentius* and those of No. 7857 and of No. 7923, using the bones of the first named as standards of comparison.

Relative measurements of bones of E. laurentius?, of No. 7857, and of No. 7923.

Bones.	<i>E. laurentius?</i> .	No. 7857.	No. 7923.
Humerus.....	100	113.7	117.7
Radius.....	100	113.1	112.1
Metacarpal 3.....	100	104.2	113.1
First phalange.....	100	103.9	114.5
Second phalange.....	100	109.1	124.2

It is seen that all the bones of the numbers 7857 and 7923 are longer than the corresponding ones referred to *E. laurentius*. This table brings out well the differences among the three horses as displayed in the fore limb. In the case of 7857 the greatest difference between it and *E. laurentius?* is in the humerus; this disparity diminishes in the lower bones until the second phalange is reached. In No. 7923 the disparity in the length of the longer bones is greatest in the case of the humerus; it is reduced in the radius, but rises higher and higher in the lower bones.

The following table is taken from that given on page 569. Only the bones of the fore leg are considered, the humerus, the radius, the median metacarpal, and the first and second phalanges. In the case of each of these its length is regarded as being 100 and certain diameters are expressed in hundredths of this.

Showing diameters of bones in hundredths of the length.

Bones compared.	Arabian.	<i>E. laurentius?</i>	No. 7857.	No. 7923.
Humerus, length.....	100.0	100	100.0	100.0
Greatest width at upper end.....	41.0	36.3	31.9	34.2
Side-to-side diameter at middle.....	12.3	13.3	12.4	13.7
Diameter across lower end.....	26.7	29.4	27.6	28.4
Radius, length.....	100.0	100.0	100.0	100.0
Greatest width at upper end.....	24.2	27.2	26.5	28.0
Fore-and-aft diameter at middle.....	8.2	9.8	8.8	10.1
Side-to-side diameter at middle of length.....	11.3	14.1	13.1	13.8
Greatest width near lower end.....	22.7	23.8	22.5	24.8
Width of distal articular surface.....	19.0	20.0	19.8	21.8
Median metacarpal, length.....	100.0	100.0	100.0	100.0
Side-to-side diameter of upper end.....	22.5	23.4	23.4	22.8
Fore-and-aft diameter at middle of length.....	11.7	12.6	13.1	13.2
Side-to-side diameter at middle of length.....	12.1	15.9	16.0	16.6
Side-to-side diameter at lower end.....	22.1	22.0	23.4	22.0
First phalange, length.....	100.0	100.0	100.0	100.0
Width of upper end.....	65.9	71.0	78.4	70.1
Width of middle of length.....	41.2	47.3	43.0	46.0
Width at lower articular surface.....	55.2	56.6	59.5	59.7
Second phalange, length.....	100.0	100.0	100.0	100.0
Width of upper end.....	157.1	133.0	152.8	144.0
Width of middle of length.....	134.2	124.0	127.7	122.0
Width across lower articular surface.....	154.3	130.3	141.7	129.2

A study of the tables just presented shows that there is, among the bones of the four limbs measured, a considerable amount of differences, not only in length but in proportions. The humerus of *E. laurentius?* is shorter than either of the other two fossil forms; it is also thicker at the ends, while the diameter at the middle of the bone is, relatively to the length, greater than in No. 7857, less than in No. 7923. On comparing the humeri of the numbers just mentioned it is seen that the first mentioned is slenderer than the others.

The radius also of *E. laurentius?* is shorter than it is in the other two limbs, whose radii are of about equal length. That of *E. laurentius?* is intermediate in its diameter between the other two in the first, second, and fourth measurements. As regards No. 7857 and 7923, the radius of the latter is in all respects a stouter bone.

The median metacarpals of the three fossil limbs are much alike in their proportions and there are relatively small differences in their absolute lengths. That of *E. laurentius* is slightly slenderer than those of the other two. As compared with the Arabian horse, the three fossil forms have the metacarpals considerably stouter.

The first phalange of *E. laurentius?* is shorter than that of each of the other two limbs. That of No. 7857 is relatively broader at the ends and more constricted at the middle. In all three the bone is heavier than it is in the Arabian horse.

Greater differences in proportions are found among the second phalanges; it is possible that these short bones, broader than long, afford greater individual variations than the longer bones.

To the writer it appears that the measurements of the limb bones above recorded indicate with considerable certainty that there existed in the region of northwestern Nebraska, in the early part of

the Pleistocene, at least three distinct species of horses; and that thus are confirmed conclusions which have been derived from studies of skulls and teeth. It is to be hoped that soon limbs may be found associated with skulls.

EXPLANATION OF PLATES.

PLATE 30.

Bison sylvestris. Type.

FIG. 1. Right hinder angle of skull, seen from above. $\times \frac{1}{2}$.

2. Left side of rear of skull, seen from below. $\times \frac{1}{2}$.

1. Basioccipital. 2. Petrosal. 3. Basisphenoid. 4. Alisphenoid. 5. Pterygoid processes. 6. Occipital condyles. 7. Base of paroccipital process. 8. Cavity into which opens the condylar foramen. 9. Foramen lacerum posterius. 10. External auditory meatus. 11. Postglenoid foramen. 12. Glenoid fossa. 13. Foramen lacerum medius. 14. Foramen ovale, confluent with 13. 15. Bar of bone forming floor of foramen lacerum anterius.

3. Outer face of last premolar and two molars of right side of lower jaw. $\times 1$.

4. Inner face of the same teeth. $\times 1$.

PLATE 31.

Boötherium nivicolens. Type. $\times \frac{1}{4}$.

FIG. 1. Face view of forehead and horn-cores.

Boötherium sargenti. Type. $\times .36$.

2. Side view of skull.

PLATE 32.

Equus hatcheri. Type. $\times \frac{1}{4}$.

Side view of skull.

PLATE 33.

Equus hatcheri. Type. $\times \frac{1}{4}$.

FIG. 1. Face view of the skull.

2. Palatal view of the skull.

PLATE 34.

Equus hatcheri. Type. $\times \frac{1}{4}$.

FIG. 1. Grinding surface of the upper premolars and molars.

2. Grinding surface of lower premolars and molars.

PLATE 35.

Equus francisci. Type.

- FIG. 1. Side view of the skull. $\times \frac{1}{3}$.
2. Upper molars and premolars. $\times 1$.

PLATE 36.

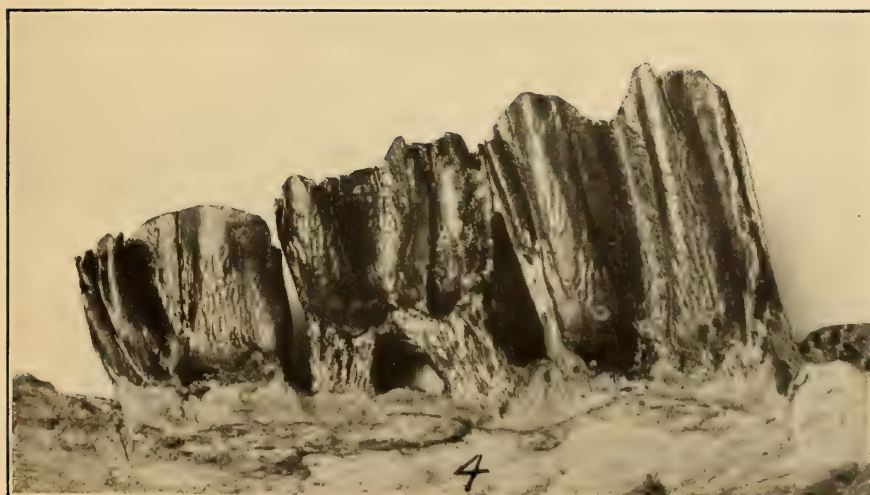
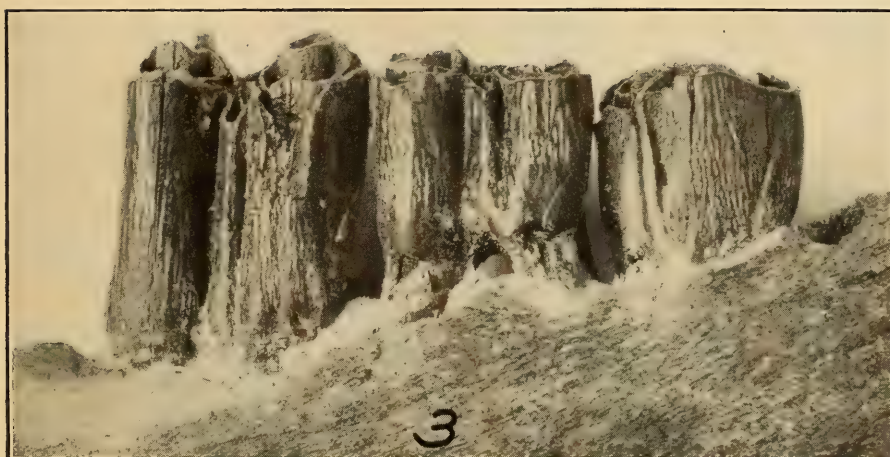
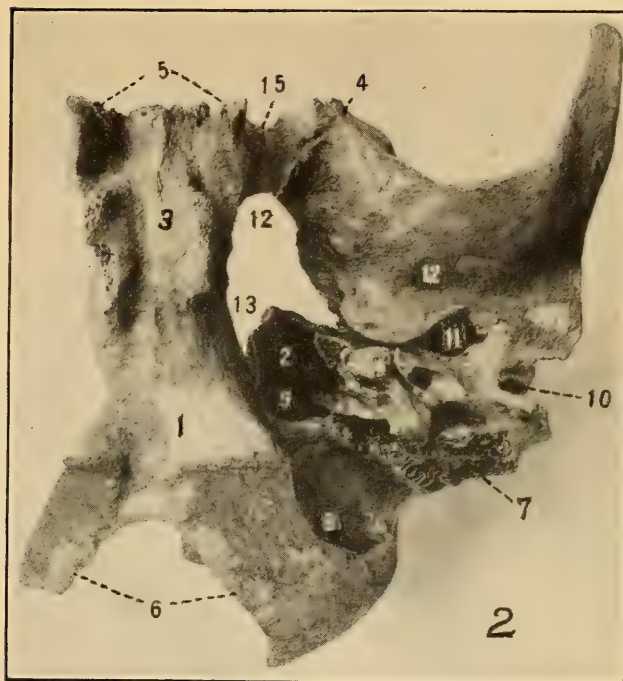
Equus francisci. Type. $\times \frac{1}{3}$.

- FIG. 1. Face view of skull.
2. Palatal view of skull.

PLATE 37.

Equus francisci. Type.

- FIG. 1. Lower jaw. $\times \frac{1}{3}$.
2. Last premolar and the molars of right side. $\times 1$.



SKULL AND TEETH OF BISON SYLVESTRIS.

FOR EXPLANATION OF PLATE SEE PAGE 574.



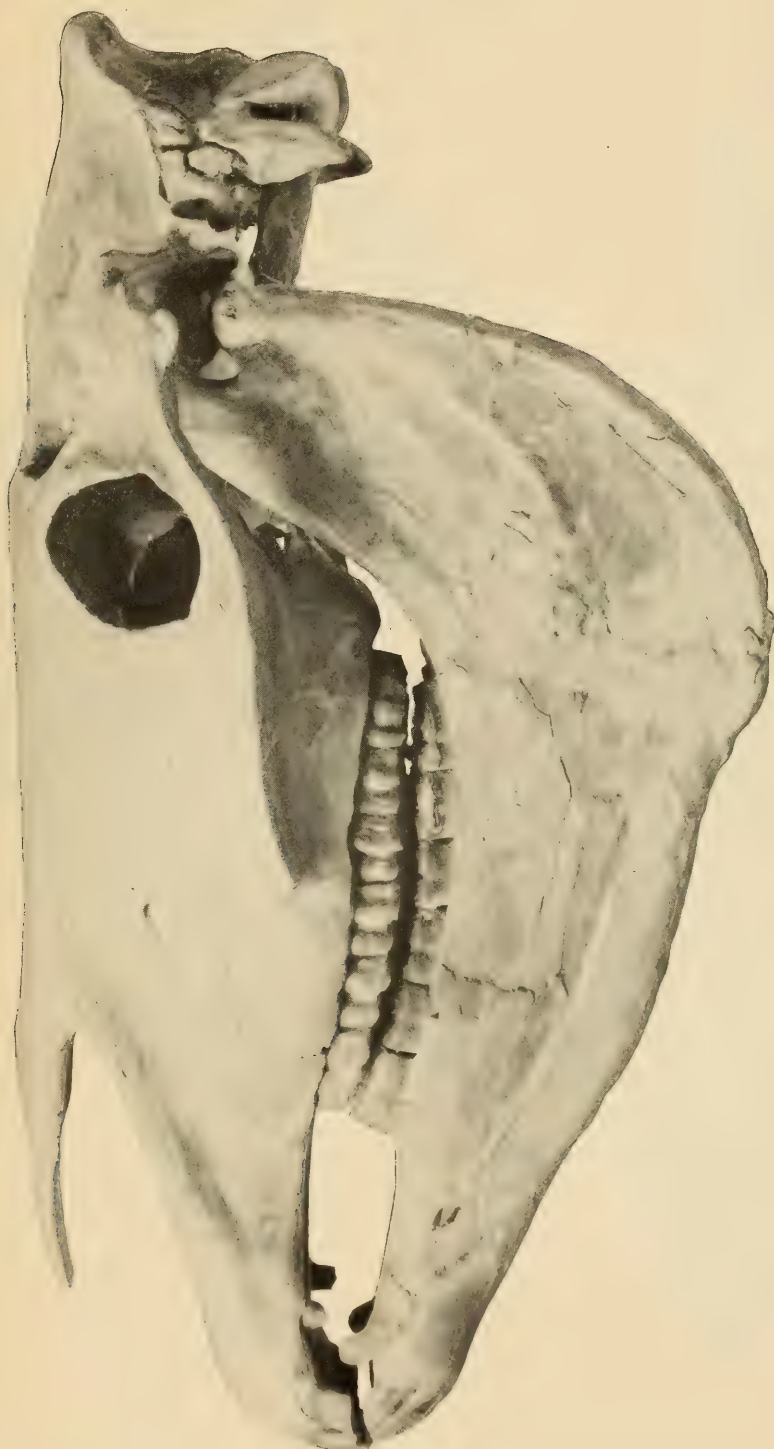
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2

FACE VIEW OF FOREHEAD AND HORN-CORES OF *BOOTHERIUM NIVICOLENS* (1) AND SIDE VIEW OF SKULL OF *B. SARGENTI* (2).

FOR EXPLANATION OF PLATE SEE PAGE 574.

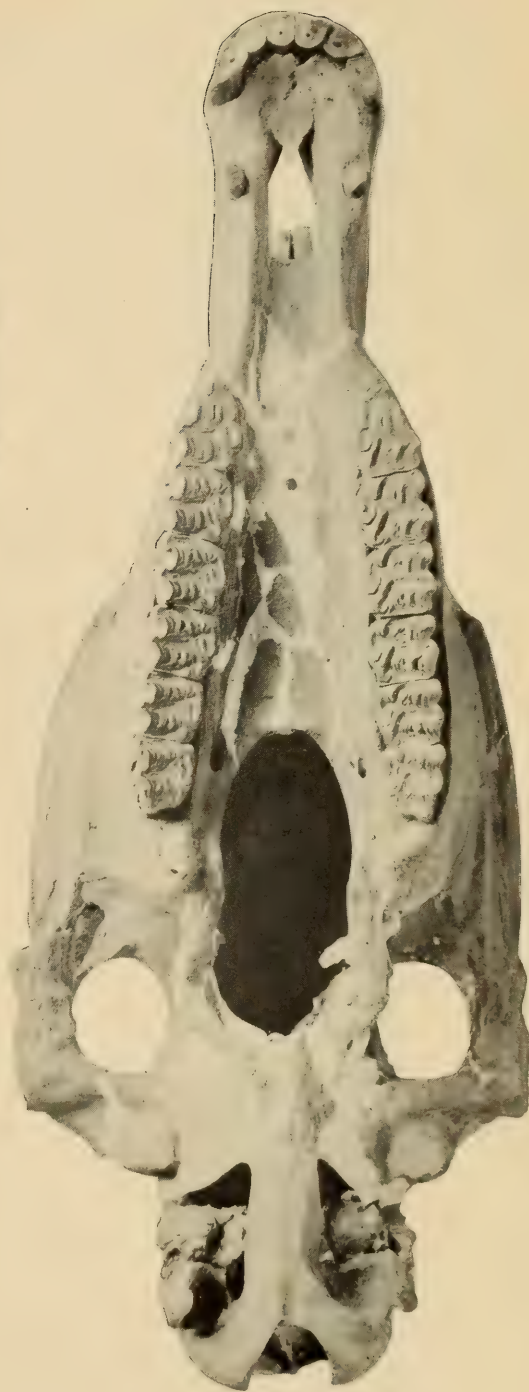


SIDE VIEW OF SKULL OF EQUUS HATCHERI.

FOR EXPLANATION OF PLATE SEE PAGE 574.



1.



2.

FACE VIEW (1) AND PALATAL VIEW (2) OF SKULL OF *EQUUS HATCHERI*.

FOR EXPLANATION OF PLATE SEE PAGE 574.



1.



2.

UPPER (1) AND LOWER (2) MOLARS AND PREMOLARS OF *EQUUS HATCHERI*.

FOR EXPLANATION OF PLATE SEE PAGE 574



1.



2.

SKULL (1) AND UPPER TEETH (2) OF *EQUUS FRANCISCI*.

FOR EXPLANATION OF PLATE SEE PAGE 575.

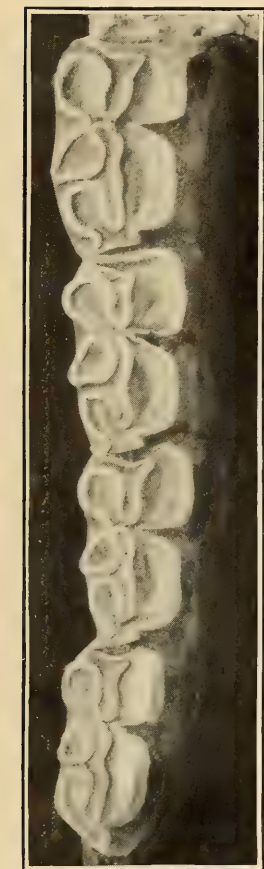


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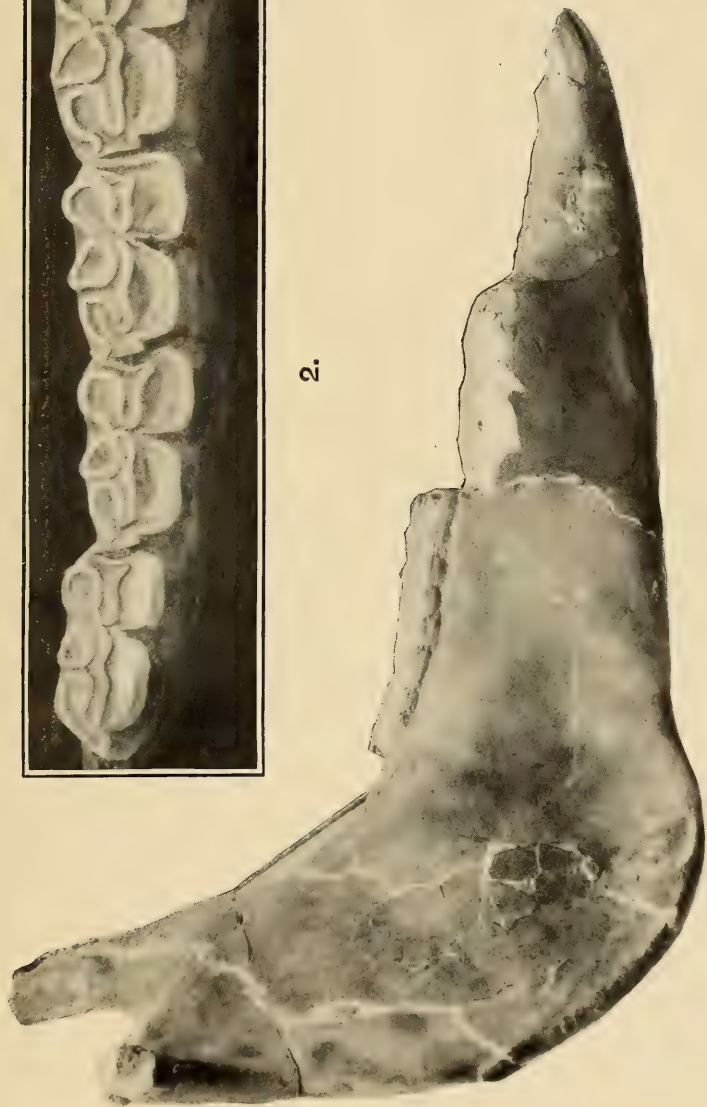
2.

FACE VIEW (1) AND PALATAL VIEW (2) OF THE SKULL OF *EQUUS FRANCISCI*.

FOR EXPLANATION OF PLATE SEE PAGE 575.



2.



1.

LOWER JAW (1) AND TEETH OF RIGHT SIDE (2) OF EQUUS FRANCISCI.

FOR EXPLANATION OF PLATE SEE PAGE 575.

DESCRIPTIONS OF NEW HYMENOPTERA, NO. 9.

By J. C. CRAWFORD,

Associate Curator, Division of Insects, United States National Museum.

In this paper are included, in addition to the descriptions of new parasites of economic importance, records of some North Dakota bees from O. A. Stevens, a series of specimens having been given to the United States National Museum. All the illustrations, with the exception of those of *G. hagenowi*, were made with a camera lucida.

Superfamily APOIDEA.

MELISSODES FOXI, new species.

Melissodes trifasciata Fox, female, Trans. Amer. Ent. Soc., vol. 18, 1891, p. 347, not of Cresson.

Melissodes mimica Fox, male, Trans. Amer. Ent. Soc., vol. 18, 1891, p. 347, not of Cresson.

Female.—Length about 10–11 mm. Similar to *M. trifasciata* Cresson, but the pubescence of head and thorax ochraceous instead of griseous, the plurae with no dark hairs; front and middle tibiae and middle and hind femora, in addition to the tarsi and hind tibiae, fulvous; abdominal hair bands more ochraceous.

Male.—Length about 8 mm. Similar to the female, but with the clypeus, labrum, and base of mandibles lemon yellow; legs, except coxae and trochanters, fulvous.

Habitat.—Portland, Jamaica.

Type.—Cat. No. 18179, U.S.N.M. (female).

Four males and four females from the Fox collection, three of the males (paratypes) being labeled only "Jamaica."

In the collections of the United States National Museum are two females from Utuado, Porto Rico, collected in January, 1899, by Mr. August Busck, which, while they have the thorax clothed with griseous rather than fulvous pubescence and the abdomen with a metallic luster, are certainly the true *M. trifasciata* of Cresson, and are the ones used in the comparison made in the above description.

M. mimica Cresson has, as a reexamination of the type by Mr. E. T. Cresson, jr., shows, the clypeus only, yellow. *M. rufodentata* Fabricino, male, is very similar in general appearance to *foxi* but the dorsum of the mesonotum is without dark hair.

MEGACHILE DAVIDSONI Cockerell.

The United States National Museum has four females and two males of this from Los Angeles County, California, June, collection Coquillett, and a male and female from Roosevelt, California, July 1, 1913, J. E. Graf, collector. The male has the sculpture of the female, but lacks the remarkable projection on the clypeus as well as the basal tooth of the mandibles. In the male the clypeus has at apex a short median carina and the lateral angles are produced; the mandibles on the lower margin slightly beyond the middle have a large tooth which on its distad margin is furnished with a golden fringe; the anterior coxae have a long spine; joints one and two of the anterior tarsi are dilated, joint 3 distinctly longer than first or second, the fourth slightly shorter and the fifth slightly longer than third; last dorsal segment strongly notched at apex, and with a tooth on each side at base.

OSMIA GEORGICA Cresson.

Osmia louisiana COCKERELL.

A specimen of this species collected at Plummer's Island, Maryland, May 15, 1914, on *Phacelia dubia* (Crawford, collector) has been compared with the type by Mr. Rohwer and it is identical with Professor Cockerell's type.

PROTOXAEA GLORIOSA (Fox).

Five females from Sabinal, Texas, all collected by Mr. F. C. Pratt; two were taken June 10, 1910, one of them "on *Salvia*;" three June 13, 1910, one "on *Salvia*," two "on *Salvia pitcheri*;" one male from Barstow, Texas, A. W. Morrill, collector, marked "Aug. 11-12, 1905."

These specimens did not correspond in all particulars with the original description and Mr. J. R. Malloch was kind enough to examine the types and found that the furrow from the anterior ocellus extends only to lower margin of antennal sockets; that the furrow on the labrum is not always distinct, that the punctures of the clypeus medially are finer and sparser than elsewhere and do not make transverse rugae, and that the depressed apical margins of the abdominal segments are greenish.

This agrees perfectly with the specimens before me. In them the labrum is best described as being medially longitudinally rugose and the clypeus as having a median, longitudinal, shiny, sparsely punctured line.

PROTOXAEA TEXANA (Friese).

Victoria, Texas, "9.8.11" in cotton field, J. D. Mitchell, one male.

CALLIOPSIS ABDOMINALIS Cresson.

Seventy-four specimens from Cotulla, Rosser, College Station, Calvert, Hallettsville, Clarendon, Wolf City, and Dallas, Texas, indicate that the normal form has the scutellum and metanotum together

with more or less of the propodeum fulvous. The species varies considerably, as some specimens have the mesonotum and part of the plurae fulvous, and the black on the abdomen is also sometimes almost lacking. In none of the females of the series before me are the scutellum and metanotum black and in only two males is this true. In a few males these sclerites are only obscurely reddish.

PANURGINUS PIERCEI Crawford.

Mr. O. A. Stevens has this species from Fargo, Dickinson, and Valley City, North Dakota, taken on *Helianthus annuus*, *H. petiolaris*, *H. maximiliani*, *H. scaberrimus*, and *Grindelia squarrosa*. Of the four males taken, three have normal face markings, but the fourth had the dog-ear marks yellow. In two of these specimens the depressed median line on the clypeus is not very distinct

PANURGINUS MALVASTRI Swenk and Cockerell.

Dickenson, North Dakota, on *Malvastrum coccineum* July 4, 1912, two females (C. H. Waldron, collector) in the collection of Mr. O. A. Stevens, one of which has been given to the United States National Museum.

PANURGINUS SIMULANS Swenk and Cockerell.

Fargo, North Dakota, on *Helianthus annuus* (cultivated), *H. maximiliani*, 9 males, 11 females; on *Taraxicum taraxicum* 1 male, Dickinson, North Dakota, on *H. petiolaris* 1 male. All from the collection of O. A. Stevens. Of the 10 males only 3 have any yellow on the front of the scape.

PANURGINUS RENIMACULATUS Cockerell.

Mr. Stevens took the sexes of this species together, and the male is not the one assigned to the species by Swenk and Cockerell. The true male resembles that of *P. nebrascensis* very closely but has the flagellum light yellowish-red beneath (in *nebrascensis* it is dark or at most obscurely reddish).

Mr. Stevens took 30 females at Fargo, North Dakota, on *Aster exiguus*, *A. chinensis*, *A. paniculatus*, *Grindelia squarrosa*, and *Boltonia asteroides* and one at Grand Forks on *G. squarrosa*; 15 males at Fargo and one at Grand Forks on *G. squarrosa*; also one at Dickinson on *H. petiolaris*.

PANURGINUS INNUPTUS Cockerell.

There is in the collection of the United States National Museum one male which I collected at West Point, Nebraska, on *Bidens*, which has the labrum yellow. Mr. Stevens took this species and also *P. nebrascensis* at Fargo, North Dakota.

In his collection there are also some females which do not belong to any of the above species, so that there are still some forms to be recorded from his region.

HALICTUS MARINUS Crawford.

On August 8, 1913, Mr. Frederick Knab took at Virginia Beach, Virginia, four males and two females of this species. He stated that the species was abundant on grasses on the beach just above the high tide limit.

AUGOCHLORA SORDISCUTIS Vachal.

The collections contain several females from San Jose, Costa Rica (Crawford, collector). One of the original series was sent to Mr. Vachal, and the determination was made by him.

Superfamily CYNIPOIDEA.**Genus XYALOSEMA** Dalla Torre and Kieffer.*Solenaspis* ASHMEAD.

In the table of genera by Dalla Torre and Kieffer¹ there are several characters, which a reexamination of the genotype shows are incorrect. The eyes are hairy, the marginal cell is open along the anterior border, and the scutellum does not possess a median furrow but rather a subdepressed area bounded on each side by an indistinct longitudinal carina. In some specimens of *X. bifoveolata* Cresson from the West Indies these two carinae are very distinct.

XYALOSEMA BIFOLEATA (Cresson).

This species described in the genus *Aspicera* must be transferred to this genus.

ANDRICUS CHAMPIONI Cameron.

Cynips championi CAMERON, Biol. Cent. Amer. Hym., vol. 1, p. 70.

Andricus championi ASHMEAD, Ent. News, vol. 10, 1899, p. 193.

Cynips ashmeadi DALLA TORRE and KIEFFER, Das Tierreich, fasc. 24, 1910, p. 440.

Dr. A. Duges in a letter to Dr. L. O. Howard wrote that Ashmead was in error in stating that his specimens came from the roots of oak, that on the contrary they came from twigs. It was due to this error that Dalla Torre and Kieffer considered that the Ashmead material must be another species and gave a new name for it.

Superfamily SERPHIDOIDEA.**HEXAPLASTA MARLATTI**, new species.

Female.—Length about 1.25 mm. Dark chestnut brown with the head and apex of the abdomen somewhat darker; legs, including coxae, almost honey color; base of antennae almost the same as legs, the club brownish, pedicel distinctly shorter than the scape, first joint of funicle almost twice as long as pedicel (fig. 1); scutellum,

¹ Das Tierreich, Lief. 24, p. 73, 1910.

except elevation, irregularly rugose, the elevation at base with a large fovea and in front of it two large punctures on each lateral margin; wings hyaline, veins light yellowish, first abscissa of the radius distinctly shorter than the second.

Male.—Length about 1.12 mm.; antennae about

1.5 mm. Similar to the female but darker in color; joints of the funicle almost three times as long as broad (fig. 2).

Type-locality.—Warrenton, Virginia.

Described from two females and three males reared by Mr. C. L. Marlatt from cow dung with *Haematobia* under dates September 10, 1889 (the types and two paratypes), and September 13, 1889, and recorded under Bureau of Entomology number 4285/22.

Type.—Cat. No. 18296, U.S.N.M.

The species is named in honor of the collector.

The antennal drawings are both from the type-specimens and were made with a camera lucida from slide mounts.

HEXAPLASTA FUNGICOLA, new species.

Female.—Length about 1.25 mm. Black, abdomen basally, especially on sides, dark reddish; legs, including coxae, light brown, femora and tibiae slightly darker; antennae reddish brown, club somewhat darker, scape short, the pedicel almost as long as scape, slightly shorter than the first joint of the funicle (fig. 3); scutellum, except elevation, irregularly rugose, elevation of scutellum with a large fovea apicad and in front of it two large punctures on each lateral margin; wings hyaline, the veins almost whitish, first abscissa of the radius very slightly shorter than the second.

Male.—Length about 1 mm.; antennae about 1.25 mm. Similar to the female, except in secondary sexual characters; joints of the funicle about twice as long as broad (fig. 4).

Type-locality.—Washington, District of Columbia.

Type.—Cat. No. 18297, U.S.N.M.

Described from eight females and seven males from a large series reared from Dipterous larvae in mushrooms, *Russula pectinata*, *R. roseipes*, and *Armillaria mellea*, collected July 3–August 30, by Mr. C. H. Popenoe and Miss M. T. Van Horn.



FIG. 1.—HEXAPLASTA MARLATTI. FEMALE ANTENNA.



FIG. 2.—HEXAPLASTA MARLATTI. MALE ANTENNA.



FIG. 3.—HEXAPLASTA FUNGICOLA. ANTENNA OF FEMALE.



FIG. 4.—HEXAPLASTA FUNGICOLA. ANTENNA OF MALE.

HEXAPLASTA WEBSTERI, new species.

Female.—Length, about 1.75 mm. Black, the legs, including coxae, ferruginous, more or less stained with dusky on femora and apices of tibiae; antennae dark brown (fig. 5); occiput with transverse rugae; elevation of scutellum at apex with a large fovea and in front of it along each lateral margin, two large punctures; scutellum laterad of elevation longitudinally rugose, the rugae slightly curved and subparallel with the sides of the elevation; scutellum apicad of elevation irregularly rugose; propodeum with two rather widely separated longitudinal carinae, between them just back of



FIG. 5.—HEXAPLASTA WEBSTERI. FEMALE ANTENNA.

middle a large depression; wings hyaline, veins reddish-honey color; first abscissa of the radius almost as long as the second.

Habitat.—Wellington, Kansas.

Host.—*Euxesta nitidiventris*.

Type.—Cat. No. 18295, U.S.N.M.

Described from three specimens under Bureau of Entomology, United States Department of Agriculture. Webster No. 7327, H. T. Osborn, collector.

The species is named after Prof. F. M. Webster.

The sketch of the antenna is from the right antenna of the type, mounted in balsam.

HEXAPLASTA ZIGZAG Riley.

For comparison with the new species described here a drawing of the female antenna, made from one of the type series, is given (fig. 6).



FIG. 6.—HEXAPLASTA ZIGZAG RILEY. ANTENNA OF FEMALE.

FIGITES POPENOEI, new species.

Female.—Length, about 2.5 mm. Black; antennae, except scape, red; pedicel slightly longer than broad, first joint of funicle as long as scape, second very slightly shorter than the first, the following shorter, subequal in length, the last joint about as long as the first; face above antennae finely reticulated, below rugulose and reticulated, post-vortex rugulose, post-orbits finely reticulated; mesoscutum smooth, parapsidal furrows very slightly broadened posteriorly, between them at apex an elongate triangular depression; mesoscutum at base with two indistinct lines extending caudad about half the length of scutum, parapsidal areas at outer edge with longitudinal furrow, the disk with a longitudinal elevated carinate line, scutellum

irregularly rugose, the foveae at base separated by a rather wide wall, rugae on middle of scutellum somewhat elevated; legs, except the almost black coxae, reddish, the hind femora brown; wings hyaline, the veins almost colorless; first abdominal segment strongly longitudinally rugose, second segment at base with short finer rugae.

Male.—Length, about 2.5 mm. Similar to the female; face below antennae with finer sculpture than in female and with two large smooth spots; pedicel globular, first joint of funicle longer than the scape, second joint of funicle indistinctly shorter than the first, the following joints almost subequal in length, the last joint slightly longer than the preceding; legs somewhat darker in the female; second abdominal segment without carinae.

Type-locality.—Washington, District of Columbia.

Type.—Cat. No. 18293, U.S.N.M.

The species is named in honor of Mr. C. H. Popenoe, who accumulated the series of fungus insects.

Described from three females and one male reared from *Boletus bicolor* collected July 23, 1912, one female issuing August 10, 1912, the other specimen, September 9, 1912.

Differs from the description of *F. albinervis* in having the posterior orbits not transversely striate and in the second joint of the funicle being about as long as the first.

ZELOTYPA FUNGICOLA, new species.

Female.—Length, about 2.5 mm. Very dark brown, with the legs, including coxae, and the scape and pedicel light yellow; rest of antennae light brown; pedicel slightly longer than broad, shorter than first joint of funicle but about as long as second joint of funicle; petiole, seen from above, somewhat swollen medially and with the carinae almost absent, the medial carina more or less apparent at base and at apex; second segment of abdomen with a basal medial longitudinal depression and on each side of it a few short ones; wings almost hyaline, marginal cell short, about twice as long as the marginal vein, recurrent nervure obsolete, represented only by a darkened line.

Male.—Length, about 2 mm. Similar to the female but the first three joints of the antennae yellowish, the pedicel almost globular, first joint of the funicle strongly excised beneath, antennae not reaching to apex of petiole, petiole slightly shorter than in female, more distinctly swollen and with the dorsal carinae more indistinct; recurrent nervure present.

Type-locality.—Clarendon, Virginia.

Described from numerous specimens reared from Dipterous larvae in *Boletus felleus* collected October 6, 1911, by Mr. B. A. Reynolds.

Type.—Cat. No. 18294, U.S.N.M.

This species differs from all those described by Ashmead in having the petiole above not striate and by its being swollen medially.

Genus GENIOCERUS Ratzeburg.

To this genus Kourdumoff assigns those species formerly referred to the genus *Tetrastichus*, which have more than one bristle on the submarginal vein. This is unsatisfactory, since it brings together species which have from one to four ring joints in the antennae. In many of these species, the ring joints are so minute as to appear

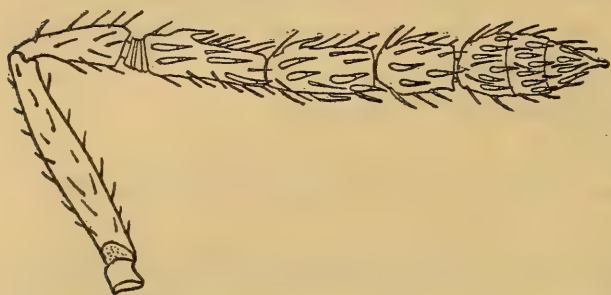


FIG. 7.—GENIOCERUS HAGENOWI. FEMALE ANTENNA.

as one unless resolved under a very high power. To illustrate this point, I give here an illustration of the antenna of *G. hagenowi* (fig. 7), which under ordinary magnification appears to have one ring joint and a detailed drawing, greatly enlarged (fig. 8), showing

more plainly the four ring joints which occur in this species, both drawings being made from a slide mount. Other species belonging to this genus, as restricted by Kourdumoff, which I have examined, have only one ring joint and still others two or three, it being impossible, as in *hagenowi*, to tell the correct number unless a slide mount is made of an antenna.

Mr. Girault has attempted to divide this series, using the number of ring joints together with the median furrow on the mesoscutum. Kourdumoff has pointed out that this latter character is of absolutely no value, since in a series of the same species specimens will be found with the furrow and others without it. In describing new species I have, therefore, for the present simply used the divisions as made by Kourdumoff.

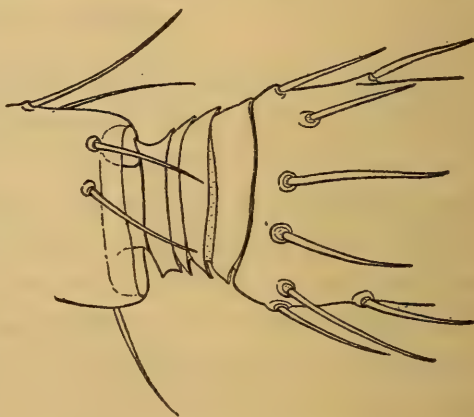


FIG. 8.—GENIOCERUS HAGENOWI. DETAIL OF FEMALE ANTENNA TO SHOW RING JOINTS.

GENIOCERUS CHRYSOPAE, new species.

Female.—Length about 1 mm. Dark green, antennae brownish testaceous, with one ring joint (fig. 9); mesoscutum and scutellum finely longitudinally sericeously lineolate, median furrow on mesoscutum and median pair of furrows on scutellum indistinct, the latter about one-third as far apart as length of scutellum; propodeum almost

twice as long as metanotum, without a median carina, the spiracles very large, round, prominent; submarginal vein with two bristles; femora dark brown, tibiae and tarsi, except apical joint, yellowish white.

Habitat.—Batesburg, South Carolina.

Type.—Cat. No. 18380, U.S.N.M.

Reared from cocoons of *Chrysopa* in connection with various other parasites under Bureau of Entomology, United States Department of Agriculture, Hunter number 3414. The lack of a median carina on the propodeum is characteristic of this species.

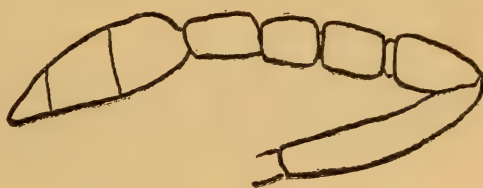


FIG. 9.—GENIOCERUS CHRYSOPAE. FEMALE ANTENNA.

GENIOCERUS JUNIPERI, new species.

Female.—Length about 1.5 mm. Lemon-yellow, with dark brown markings on the rear of head, front of pronotum, a small brown spot on each lateral angle of pronotum, and one on front of axillae; suture between mesoscutum and scutellum brown; propodeum medially, spot on each side of abdominal segments and the apical margins of segments more or less suffused with brownish scape yellow with a brown spot above, rest of antennae brownish; joints of funicle elongate (fig. 10);



FIG. 10.—GENIOCERUS JUNIPERI. FEMALE ANTENNA.

seen under high power, the antennae show three ring joints; head and thorax finely sericeous; median furrow of mesoscutum rather indistinct, median pair of furrows on scutellum about half as far apart as length of scutellum; propodeum with median carina hardly as long as the metanotum; submarginal vein with about four bristles; legs yellow with the apical joint of tarsi brown; venter along median line somewhat brownish; sheaths of ovipositor apically distinctly brown.

Type-locality.—Ithaca, New York.

Type.—Cat. No. 18381, U.S.N.M.

Described from 11 specimens reared from berries of *Juniperus virginiana* by Mr. S. Marcovitch and sent under his number lot 30, sub 8 with the additional information that the species is phytophagous. Paratypes vary in having more brown, the mesoscutum medially with a large brown spot in front; vertex, parapsidal areas anteriorly, sides of propodeum with brown spots; the abdomen with the brown bands more pronounced.

GENIOCERUS MARCOVITCHI, new species.

Female.—Length about 2 mm. Blue-black or greenish-black; joints of the funicle elongate (fig. 11); under high power the antennae show three ring joints; mesoscutum and scutellum finely longitudinally sericeous, median furrow on mesoscutum indistinct; metanotum with two yellow spots on disk; propodeum with median carina short, hardly as long as the metanotum; submarginal vein with



FIG. 11.—GENIOCERUS MARCOVITCHI. FEMALE ANTENNA.

three or four bristles; legs blue-black, the knees, extreme bases and apices of tibiae and tarsi except apical joint whitish.

Allotype.—Length, 1.75 mm. Similar to the female, the first joint of the funicle about as long as pedicel, much shorter than the second joint, joints 2 to 4 being subequal in length, club not enlarged, almost twice as long as last joint of funicle; tibiae yellowish-white with a brown stripe inwardly.

Habitat.—Ithaca, New York.

Type.—Cat. No. 18382, U.S.N.M.

Described from three females and one male reared from berries of *Juniperus virginiana* by Mr. Marcovitch and sent under his number lot 30, sub 17. It appears to be a parasite of the phytophagous *Eurytoma* living in these berries.

GONATOCERUS GIBSONI, new species.

Female.—Length about 1 mm.; sheaths of ovipositor about 0.33 mm. Very dark brown, base of abdomen narrowly light yellow; antennae slightly longer than insect, brown, the scape much lighter; first joint of funicle about as long as pedicel, second and third joints longer, subequal, fourth very slightly longer, fifth, sixth, and seventh longer than fourth, subequal, eighth shorter, about as long as first; club about twice as long as fifth joint, coxae and trochanters yellow, femora and tibiae, except yellow apices, light brown; sheaths of ovipositor brown, almost as long as abdomen; wings very slightly fumated; abdomen strongly compressed.

Allotype.—Length about 1 mm. Similar to the female except in secondary sexual characters, the antennae much longer than the body, joints of funicle almost equal in length, the first slightly shorter, the thirteenth somewhat longer than preceding.

Type-locality.—Tempe, Arizona.

Host.—Eggs of *Draculocephala mollipes*.

Described from specimens bred May 20, 1914, by Mr. E. H. Gibson and recorded under Webster No. 12211 sub A, the types on slides in balsam.

Type.—Cat. No. 18495, U.S.N.M.

Allied to *G. rivalis* Girault and *maga* Girault but the female differs from both in the fourth joint of the funicle not being shorter than preceding, in the more elongate antennae, and the longer ovipositor.

A SYNOPSIS OF THE RACES OF THE LONG-TAILED GOAT-SUCKER, *CAPRIMULGUS MACRURUS* HORSFIELD.

By HARRY C. OBERHOLSER,

Of the Biological Survey, United States Department of Agriculture.

This brief synopsis was originally intended as an account of the specimens of *Caprimulgus macrurus* in the United States National Museum, collected chiefly by Dr. W. L. Abbott. Considerations of convenience and completeness have, however, induced the inclusion of all the forms of the species, even though there are three of these of which it has been impossible to obtain specimens for examination, namely, *Caprimulgus macrurus nipalensis*, *Caprimulgus macrurus atripennis*, and *Caprimulgus macrurus yorki*.

The material upon which this paper is based, and for the use of which the writer is much indebted, is contained in the United States National Museum; the Academy of Natural Sciences of Philadelphia; the Museum of Comparative Zoölogy in Cambridge; and the private collection of Mr. J. H. Fleming, of Toronto, Ontario.

The names of colors here used are based on Mr. Ridgway's new Color Standards and Nomenclature.¹ All measurements are given in millimeters. Practically all the specimens examined are listed in the tables of detailed measurements; and those that are included in the diagnostic averages are indicated in the tables. The measurements here given have been taken as explained in the writer's recent paper on *Butorides virescens*.²

Several of the forms of *Caprimulgus macrurus* are well-known birds, and of frequent mention in literature, particularly in local lists. The two best accounts of the species from a technical standpoint are both by Dr. Ernst Hartert. One is in the Catalogue of Birds in the British Museum³; the other in *Das Tierreich*.⁴

Including *Caprimulgus atripennis*, which some authors regard as a distinct species, but which is probably only a subspecies, the forms

¹ Ridgway, Color Standards and Color Nomenclature, 1912 (Jan. 16, 1913).

² Proc. U. S. Nat. Mus., vol. 42, 1912, p. 533.

³ Vol. 16, 1892, pp. 537-543.

⁴ Lief. 1, 1897, pp. 53-55.

of *Caprimulgus macrurus* now number nine; not a large number, considering the great range of the species. These, taken together, cover the following geographical area: North to New Guinea, the Philippine Islands, southern China, Assam, and Nepal; west to the western Himalaya Mountains and southwestern India; south to Ceylon, Sumatra, Java, Lombok, Sumbawa, Timor, the Aru Islands, and northern Australia; and east to northern Queensland and the island of New Britain.

The close resemblance of some widely separated races is not wanting in this species. For instance, *Caprimulgus macrurus yorki*, from northern Australia, is very close in all characters to *Caprimulgus macrurus macrurus*, from Borneo and Java, though readily separable from the intervening *Caprimulgus macrurus mesophanis*.¹ Also *Caprimulgus macrurus keatsi*, from northern Australia, more nearly resembles *Caprimulgus macrurus anamesus*,² from Sumatra, than it does either of the two interposed races, *Caprimulgus macrurus macrurus* and *Caprimulgus macrurus mesophanis*.¹

Throughout most, if not all, of its range it is permanently resident, and inhabits chiefly low altitudes. It is a bird of the woodlands, and not often found away from trees. It is crepuscular and nocturnal, and in general habits is similar to other members of the genus *Caprimulgus*. Its note has been described as resembling the sound made by striking a plank with a hammer, and is often heard on moonlight nights, particularly about the margins of the forest. Its eggs are two, in color pale grayish or buffy, with brown and lavender markings.

The sexes in this species are readily distinguishable. The female differs from the male chiefly in having the broad light tips of the outer pairs of tail-feathers much smaller, and buff or light brownish instead of white; the light wing-patch much smaller, and ochraceous in place of white; also the rectrices, wing-quills, and greater wing-coverts much more strongly and distinctly barred with buff, ochraceous or tawny.

The juvenal plumage is in color similar to that of the adult, but on the upper surface is more blended, the markings there duller and less definite, those on pileum, scapulars, and tertials being finer; wing edgings more ochraceous; lower parts lighter, anteriorly more finely marked, and with throat-patch cream buff instead of white.

Seasonal change in adults consists chiefly in some paling of the plumage by wear, this sometimes resulting in the disappearance of the edges of the feathers, which latter, however, does not greatly change the general aspect of the plumage.

The molt is not well illustrated by the specimens at hand. An example of *Caprimulgus macrurus anamesus*² from Singapore (No. 175144, U.S.N.M.), collected on November 10, 1899, is molting both

¹ See p. 590.

² See p. 593.

wing-quills and contour feathers; and another bird from the same locality (No. 170441, U.S.N.M.), taken, May 19, 1899, is in the same condition. From these it may be inferred that the species, at least in adult stage, has two molts per year. Another Singapore bird (No. 170442, U.S.N.M.), taken, May 26, 1899, is just molting into the juvenal plumage.

As is the case with many goatsuckers there are two color phases in *Caprimulgus macrurus*. In one of these, which appears to be rather unusual, if not rare, the entire plumage is strongly rufescent, the abdomen particularly being more deeply ochraceous. In the other, which seems to be the normal phase, the tone of the plumage is very grayish throughout. While to a certain extent this rufescent or ochraceous tinge of the plumage is, in some cases, a subspecific character, in other cases it varies so markedly in examples of the same race that it forms a definite color phase. Other individual variations are found in the size of the white or buff tips of the outer tail-feathers, which light tips are either with or without dusky mottling on the outer webs; the coarseness of the bars and vermiculations on the anterior lower parts; and also, of course, in the size and shape of the light and dark mottlings on upper parts, wings, and tail.

The characters of value in subspecific distinctions lie chiefly in size (principally length of wing); the depth of general color tone of upper parts; the width and arrangement of the dark streaks on the pileum; the conspicuousness of the dark markings on the upper surface; and the size of the white spot on the primaries.

CAPRIMULGUS MACRURUS MACRURUS Horsfield.

Caprimulgus macrurus HORSFIELD, Trans. Linn. Soc. Lond., vol. 13, 1821, p. 142 (Java).

Caprimulgus macrourus GOULD, Birds Australia, vol. 2, 1848, pl. 9 (nom. emend. pro *Caprimulgus macrurus* Horsfield).

Caprimulgus salvadorii SHARPE, Proc. Zool. Soc. Lond., 1875, p. 99, pl. 22, fig. 1 (Labuan Island, northern Borneo).

Chars. subsp.—Size small and colors dark.

Measurements.—Male:¹ Wing, 170–188 (average, 179.2) mm.; tail, 131.5–147 (137.9); exposed culmen, 8.7–11 (9.7); tarsus, 16–17.5 (16.6).

Female:² Wing, 178–179 (average, 178.5) mm.; tail, 130–130.5 (130.3); exposed culmen, 9–10.2 (9.6); tarsus, 16–16.5 (16.3).

Type-locality.—Java.

Geographical distribution.—Java; Borneo; Labuan Island; Palawan and Calamianes islands in the Philippines; also probably the islands of Celebes,³ Saleyer,³ Djampea,³ Lombok,³ Sumbawa,³ and Timor.³

¹ Nine specimens, from Java, Borneo, and the Philippine Islands.

² Two specimens, from Java and Borneo.

³ No specimens examined from this locality.

Remarks.—This, the smallest of the dark forms of the species, was first described by Horsfield from Javan specimens.¹ There seems to be no constant appreciable difference in either size or color between the birds from Java and those from Borneo or the Philippine Islands. The *Caprimulgus salvadorii* of Sharpe,² from Labuan Island, North Borneo, is, therefore, a synonym of *Caprimulgus macrurus macrurus*. The colors of the unfeathered portions in this race are, in life, as follows: Iris dark brown; bill grayish brown, the tip black; feet grayish brown.

There are in *Caprimulgus macrurus macrurus* two color phases: one in which the entire plumage is of a grayish general tone and very dark; another which has a decidedly rufescent tone throughout, and is always somewhat, sometimes much, paler.

Measurements of specimens of Caprimulgus macrurus macrurus.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
					mm.	mm.	mm.	mm.
U.S.N.M. 219393 ³ ..	Male....	Depok, Java.....	July 31, 1909	W. Palmer..	170	134	10.5	16.5
U.S.N.M. 219391 ³ ..	do.....	Daroe, Java.....	June 20, 1909	do.....	180.5	147	8.7	16.5
M.C.Z. 60131 ³ ..	do.....	Depok, Java.....	July 16, 1909	do.....	176.5	134	11	16
U.S.N.M. 210982 ³ ..	do.....	Puerto Princesa, Palawan Island, Philippine Islands.	Jan. 3, 1906	A. Celestino and Canton.	172	131.5	10	16
J.H. Fleming 15158 ³	[Male]...	Labuan Island, northern Borneo.	Feb. —, 1892	A. H. Everett.	183	139	10	16.5
A.N.S. Phila. 50530 ³	Male.....	do.....	June —, 1893	do.....	182	138	9.5	17.5
A.N.S. Phila. 50495 ³	do.....	do.....	May 13, 1893	do.....	175	131.5	.....	17
A.N.S. Phila. 50496 ³	[Male]...	Kudat, northern Borneo.	Jan. —, 1895	J. B. Bell...	186	142	9	17
M.C.Z. 39662 ³	Male.....	Pontianak, Borneo.	Feb. 11, 1895	J. Büttikofer	188	144	9.2	16.5
A.N.S. Phila. 56191 ³	Female..	Palaboean, Ratoe, Java.	{Oct. 8, 1898 to Jan. 31, 1899	{J. Z. Kanne-gieter.	178	130.5	10.2	16.5
A.N.S. Phila. 60859 ³	do.....	Baram, Sarawak, Borneo.	Jan. —, 1896	.....	179	130	9	16

³ Used in measurement averages on p. 589.

CAPRIMULGUS MACRURUS MESOPHANIS, new subspecies.

Chars. subsp.—Like *Caprimulgus macrurus macrurus*, from Java, but much larger.

Description.—Type, adult male, No. 178092, U.S.N.M.; Amboina Island, Molucca Islands, June 12, 1897; C. Schädler. Upper parts deep clove brown, more or less mottled with tawny, ochraceous, buff, light brownish gray, and blackish clove brown, least so on back, but the pileum largely light brownish gray, medially with heavy streaks of blackish clove brown, forming a broad stripe, and the scapulars with broad subterminal areas of deep rich velvety blackish brown, and narrower terminal markings of buff and ochraceous, these latter wider on outer webs; an indistinct and much broken cervical collar

¹ Trans. Linn. Soc. Lond., vol. 13, 1821, p. 142.

² Proc. Zool. Soc. Lond., 1875, p. 99, pl. 22, fig. 1.

of tawny; wings dull clove brown, all the superior coverts, and the quills except the four outermost primaries, much mottled on both webs with buff, ochraceous or tawny, the greater, median, and longer lesser wing-coverts broadly tipped with buff, ochraceous buff or cream buff, forming three conspicuous, somewhat irregular wing-bars; a large white speculum on the four outer primaries, occupying only the inner web of the outermost feather, but both webs of the rest, and passing into an ochraceous buff smaller spot on the fifth quill; tail deep blackish clove brown, more or less mottled with dull light grayish brown and ochraceous, most so on the middle feathers, and chiefly in the form of irregular and partly obsolescent bars, the two exterior feathers on each side with very broad white ends, but the terminal portion of outer web of these two outer feathers laterally a little shaded with dusky; chin and sides of head tawny, barred and vermiculated with blackish clove brown, the auriculars ochraceous and but little marked with dark brown; lower throat and sides of the neck tawny and tawny ochraceous, heavily barred with blackish clove brown; upper throat triangularly white; breast grayish clove brown, so much barred and vermiculated with pale brownish, grayish, tawny, ochraceous, buff, and whitish that the ground color is largely obscured; abdomen, lining of wings, and lower tail-coverts ochraceous tawny, broadly barred with clove brown, the longest lower tail-coverts paler and but little barred.

Measurements.—Adult male:¹ Wing, 189 mm.; tail, 140; exposed culmen, 10.5; tarsus, 14.

Type-locality.—Amboina Island, Molucca Islands.

Geographical distribution.—The Molucca Islands.

Remarks.—This race includes the large dark birds from the Molucca Islands and probably also neighboring islands to the south and east, which many authors have apparently considered the typical *Caprimulgus macrurus macrurus*. The latter really is, as already noted, a much smaller bird. The type of *Caprimulgus macrurus mesophanis* is the only specimen that we have actually examined.

CAPRIMULGUS MACRURUS YORKI Mathews.

Caprimulgus macrurus yorki MATHEWS, Novit. Zool., vol. 18, January 31, 1912, p. 291 (Cape York, northern Queensland, Australia).

Chars. subsp.—Similar to *Caprimulgus macrurus mesophanis*, but smaller.

Measurements.—Wing, 179 mm.²

Type-locality.—Cape York, northern Queensland, Australia.

Geographical distribution.—Northern Queensland.

Remarks.—This subspecies I have not seen, and if Mr. Mathews' measurements represent the average size, the race is but possibly

¹ One specimen, the type.

² Mathews, Novit. Zool., vol. 18, January 31, 1912, p. 291.

distinguishable. It comes very close to *Caprimulgus macrurus macrurus*, with which it seems to be practically identical in size, not smaller as Mr. Mathews says in the original description,¹ for he compared it evidently with the large form here separated as *Caprimulgus macrurus mesophanis*, instead of with the typical small bird from Java. I am here recognizing it largely on account of its isolated range as compared with *Caprimulgus macrurus macrurus*, and in the probability that careful comparison will reveal characters to separate it from the latter race.

CAPRIMULGUS MACRURUS KEATSI Mathews.

[*Caprimulgus*] *schlegelii* GRAY, Hand-List Gen. and Spec. Birds, vol. 1, 1869, p. 57 (Aru Islands; Dorey, New Guinea; Waigiou Island, Molucca Islands [type locality, Dorey, New Guinea]) (*nomen nudum*).

Caprimulgus macrurus keatsi MATHEWS, Novit. Zool., vol. 18, January 31, 1912, p. 291 (Point Keats, Northern Territory, Australia).

Chars. subsp.—Similar to *Caprimulgus macrurus mesophanis*, but smaller, and paler, both above and below.

Measurements.—Male:² Wing, 183 mm.; tail, 139; exposed culmen, 10; tarsus, 15.

Female:³ Wing, 174–182 (average, 177) mm.; tail, 132–136 (134.7); exposed culmen, 9.0; tarsus, 16.5.

Type-locality.—Point Keats, Northern Territory, Australia.

Geographical distribution.—Northern Territory of Australia; New Guinea; New Britain Island; Aru Islands; and probably also the Timorlaut Islands.

The single Australian specimen examined indicates that this is a recognizable race. Mr. Mathews in his original description⁴ states that it is *smaller* than *Caprimulgus macrurus macrurus*, but here again he has doubtless made comparison with *Caprimulgus macrurus mesophanis*, instead of the typical race from Java. This Australian bird is apparently of the same size as *Caprimulgus macrurus macrurus*, but is distinguishable by its paler coloration, particularly on the upper parts.

So far as I am able to judge from the limited series at my command, birds from New Guinea, allowing for the usual range of individual variation, do not differ in either size or color from typical *Caprimulgus macrurus keatsi* of the Northern Territory in Australia.

This subspecies was long ago given a tentative name by Mr. G. R. Gray,⁵ in the following fashion:

634. *Schlegelii*, n. sp. ?
macrurus, p., G. R. Gr.

Aru, Dorey, N.
G., Waigiou.

¹ Novit. Zool., vol. 18, January 31, 1912, p. 291.

² One specimen, from New Guinea.

³ Three specimens, from New Guinea and northern Australia.

⁴ Novit. Zool., vol. 18, January 31, 1912, p. 291.

⁵ Hand-List Gen. and Spec. Birds, vol. 1, 1869, p. 57.

Were this name not a *nomen nudum* it would supersede *Caprimulgus macrurus keatsi* Mathews.

Measurements of specimens of *Caprimulgus macrurus keatsi*.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
M.C.Z. 54472 ¹	Male....	Port Moresby, New Guinea.	Aug. 17, 1883	S. F. Denton	mm. 183	mm. 139	mm. 10	mm. 15
A.N.S. Phila. 21842 ¹	Female.	Port Essington, Northern Territory, Australia.	.....	.....	175	136	9	16.5
M.C.Z. 54474 ¹.....	...do....	Port Moresby, New Guinea.	July 28, 1883	S. F. Denton	182	136	.....	.....
M.C.Z. 54473 ¹.....	...do....	...do.....	...do.....	...do.....	174	132	9	16.5

¹ Used in measurement averages on p. 592.

CAPRIMULGUS MACRURUS ANAMESUS, new subspecies.

Chars. subsp..—Similar to *Caprimulgus macrurus macrurus*, but much paler and more grayish; like *Caprimulgus macrurus bimaculatus* in color, but much smaller.

Description..—Type, adult male, No. 175143, U.S.N.M.; Tanjong Kalong, Singapore Island, November 2, 1899; Dr. W. L. Abbott. Upper parts brownish gray, mottled with brownish black and ochraceous, the middle of the pileum with heavy black streaks forming a stripe, the scapulars with broad subterminal areas of rich velvety, slightly brownish, black, and narrower terminal markings of buff, these latter wider on outer webs; an indistinct collar of ochraceous; wings deep clove brown, all the superior coverts, and the quills except the outermost primaries, much mottled on both webs with ochraceous or buff, the greater, median, and longer lesser wing-coverts broadly tipped with buff, forming three conspicuous wing-bars; a large white speculum on the four outer primaries; tail brownish black, much mottled with light grayish brown and ochraceous, chiefly in the form of irregular bars, the two exterior pairs of feathers with very broad white ends; but the terminal portion of outer web of outermost feather partly dusky; chin and sides of head ochraceous, finely and closely vermiculated with blackish, the auriculars least so; lower throat and sides of neck ochraceous, the feathers with broad terminal or subterminal markings of black; upper throat triangularly white, posteriorly buffy; breast brownish gray, vermiculated with clove brown and pale ochraceous, many of the feathers with blackish shaft markings and buff tips; abdomen, lining of wing, and lower tail-coverts ochraceous buff, broadly barred with dark brown; “bill dark brown; feet brown; eye black.”

Measurements.—Male: Total length (in flesh), 279.4 mm.¹

Female: Total length (in flesh), 285.8.²

Male:³ Wing, 183–189 (average, 185.8) mm.; tail, 141–143 (141.8); exposed culmen, 10–11 (10.6); tarsus, 14.5–15.5 (15).

Female:⁴ Wing, 169.5–186 (average, 175.8) mm.; tail, 131–141 (135); exposed culmen, 8–11 (9.7); tarsus, 15–16 (15.5).

Type-locality.—Tanjong Kalong, Singapore Island, Straits Settlements.

Geographical distribution.—Singapore Island and Sumatra.

Remarks.—So completely do the specimens of *Caprimulgus macrurus* from the island of Singapore combine the small size of the dark typical form from Java, with the pale coloration of the large *Caprimulgus macrurus bimaculatus* from the Malay Peninsula, that they seem worthy a name of their own. All the specimens we have examined from Sumatra belong to this race. It does not, however, extend farther northward, for birds from the neighboring mainland of the Malay Peninsula are *Caprimulgus macrurus bimaculatus*. It seems a little remarkable that the birds of this species from the island of Singapore, so near the Malay Peninsula mainland, should differ so much and resemble rather those of the distant island of Sumatra; but this bears out what we have noticed in other groups of birds, and indicates that the island of Singapore is, in some ornithological respects at least, faunally more closely allied to Sumatra and Borneo than to the Malay Peninsula.

Measurements of specimens of Caprimulgus macrurus anamesus.

Museum and No.	Sex.	Locality.	Date.	Collector.	Total length. ⁵	Wing.	Tail.	Exposed culmen.	Tarsus.
U.S.N.M. 175143 ⁶ .	Male....	Tanjong Kalong, Singapore Island. ⁷	Nov. 2, 1899	W. L. Abbott.	mm. 279.4	mm. 183	mm. 141	mm. 11	mm. 14.5
U.S.N.M. 175145 ⁶.	...do.....	...do.....	Nov. 26, 1899	...do.....	279.4	189	143	10	15
U.S.N.M. 170440 ⁶.	...do.....	Singapore Island.	May 15, 1899	...do.....	.....	184	141	11	15
A.N.S. Phila. 21844 ⁶.	...do.....	Sumatra....	.....	.....	.....	187	142	10.2	15.5
U.S.N.M. 170441 ⁶ .	Female.	Singapore Island.	May 19, 1899	W. L. Abbott.	mm. 285.8	mm. 186	mm. 141	mm. 10	mm. 15
A.N.S. Phila. 21843 ⁶ .	[Female].	Sumatra....	.....	.....	.....	169.5	133	8	15.5
A.N.S. Phila. 21846 ⁶ .	Female.	...do.....	.....	.....	.....	172	131	11	16

¹ Two specimens.

² One specimen.

³ Four specimens, from Singapore Island and Sumatra.

⁴ Three specimens, from Singapore Island and Sumatra.

⁵ Measured in the flesh by the collector.

⁶ Used in measurement averages on p. 594.

⁷ Type.

CAPRIMULGUS MACRURUS BIMACULATUS Peale.

Caprimulgus bimaculatus PEALE, U. S. Expl. Exp., vol. 8, Mamm. and Ornith., 1848, p. 170 ("Singapore": *i. e.*, Malacca, Malay Peninsula).

[*Caprimulgus*]. *macrurus ambiguus* HARTERT, Ibis, 1896, p. 373 (Malay Peninsula, Burma, Assam, and the eastern Himalayas).

Chars. subsp.—Like *Caprimulgus macrurus anamesus*, but larger.

Measurements.—Male:¹ Total length (in flesh), 279.4–310 (average, 289.6) mm.; wing, 190–204 (193.5); tail, 135–161 (149.8); exposed culmen, 9–11.5 (10.2); tarsus, 15–17 (16.2).

Female:² Total length (in flesh), 279.4–292.1 (average, 285.8) mm.; wing, 192–199 (194.3); tail, 142–150 (145.7); exposed culmen, 9.5–11 (10.3); tarsus, 15.5–16.5 (16).

Type-locality.—Malacca, Malay Peninsula.

Geographical distribution.—Malay Peninsula, north to Tenasserim, Burma, Assam, and Province of Yunnan, southwestern China; and east to Siam, Cambodia, and Cochin China.

Remarks.—This race is very well differentiated from *Caprimulgus macrurus macrurus*, being much larger and of lighter coloration, especially on the upper surface. The colors of the unfeathered parts in life are as follows: Iris dark brown; bill brown, the tip black; feet brown, the claws dark brown or black. Like *Caprimulgus macrurus macrurus*, the present race exhibits two color phases, (1) a grayish and darker, and (2) a rufescent and paler condition, neither of which seems to be at all correlated with sex or age.

A single adult female (No. 62037, Museum of Comparative Zoölogy) from Mongtsz, in the Province of Yunnan, southwestern China, apparently does not materially differ from Malay Peninsula specimens, though it is rather darker, both above and below, than the average of *Caprimulgus macrurus bimaculatus*.

This subspecies has been recently described by Doctor Hartert, under the name *Caprimulgus macrurus ambiguus*,³ to include the birds from the Malay Peninsula, Burma, Assam, and the eastern Himalayas, but without any definite type locality. Peale's earlier name *Caprimulgus bimaculatus*⁴ is, however, undoubtedly applicable to this race, and must therefore unfortunately supplant *Caprimulgus macrurus ambiguus* Hartert. In the original description⁴ Peale says: "The specimen was obtained at *Singapore*;" but on a later page,⁵ in his Catalogue of Specimens obtained by the United States Exploring Expedition, he gives only *Malacca* for *Caprimulgus bimaculatus*. The type specimen, now in the United States National Museum,

¹ Eight specimens, from Tenasserim, Lower Siam, and Malacca, Malay Peninsula.

² Three specimens, from Lower Siam, and Yunnan, China.

³ Ibis, 1896, p. 373.

⁴ U. S. Expl. Exp., vol. 8, Mamm. and Ornith., 1848, p. 170.

⁵ Idem, p. 327.

bears two labels. The older, and probably original one of these is a manuscript label and reads:

Caprimulgus bimaculata
Malacca 14583 Peale
U S Ex — Ex —

The later label, used on the stand when the bird was part of a mounted museum exhibit, is the regular large partly printed label found on all the United States Exploring Expedition specimens, and is as follows:¹

U. S. Expl. Exped. Capt. C. Wilkes, U. S. N.
14583. *Caprimulgus albonotatus*, Tickell.
The White-spotted Goatsucker.

P. 504.

C. 385.

Obt'd at Singapore.

T. R. Peale.

Furthermore, the specimen itself, which is in a good state of preservation, is clearly an example of the form from the Malay Peninsula, not of *Caprimulgus macrurus anamesus* from Singapore, as the measurements given below indicate. There seems to be no doubt, therefore, that the type-specimen of Peale's *Caprimulgus bimaculatus* really came from Malacca, and that, consequently, the statement that it was obtained at Singapore² is an error, or, more probably, a lapsus of pen or memory.

Measurements of specimens of Caprimulgus macrurus bimaculatus.

Museum and No.	Sex.	Locality.	Date.	Collector.	Total length. ³	Wing.	Tail.	Exposed culmen.	Tarsus.
U.S.N.M. 180366 ⁴ .	Male....	Telok Besar, Tenasserim, Burma.	Mar. 1, 1904	W. L. Abbott.	mm. 310	mm. 193	mm. 161	mm. 11.5	mm. 15
U.S.N.M. 180367 ⁴ .	do.....	do.....	do.....	do.....	295	204	160	11	16.5
U.S.N.M. 160169 ⁴ .	do.....	Trong, Lower Siam.	Dec. 19, 1896	do.....	285.8	192	153.5	10.5	16
U.S.N.M. 169757 ⁴ .	do.....	do.....	Jan. 28, 1899	do.....	279.4	191	135	10	16.5
U.S.N.M. 160168 ⁴ .	do.....	do.....	Sept. 6, 1896	do.....	285.8	193	146	9.5	15.5
U.S.N.M. 153695 ⁴ .	do.....	do.....	Mar. 13, 1896	do.....	292.1	193	144	10	17
U.S.N.M. 169756 ⁴ .	do.....	do.....	Jan. 5, 1899	do.....	279.4	190	148	10	16
U.S.N.M. 14583 ⁴ .	[Male]..	Malacca, Malay Peninsula. ⁵	.....	T. R. Peale.	.....	192	151	9	17
U.S.N.M. 153696 ⁴ .	Female..	Trong, Lower Siam.	Mar. 24, 1896	W. L. Abbott.	279.4	192	145	11	15.5
U.S.N.M. 153697 ⁴ .	do.....	do.....	Apr. 14, 1896	do.....	292.1	199	150	10.5	16.5
M.C.Z. 62037 ⁴ .	do.....	Mong t sz, Yunnan, China.	Dec. 4, 1910	Kobayashi.	.....	192	142	9.5	16

¹ The portions in *italics* were inserted with a pen.

² U. S. Expl. Exp., vol. 8, Mamm. and Ornith., 1848, p. 170.

³ Measured in the flesh by the collector.

⁴ Used in measurement averages on p. 595.

⁵ Type.

CAPRIMULGUS MACRURUS ALBONOTATUS Tickell.

Caprimulgus albonotatus TICKELL, Journ. Asiat. Soc. Bengal, vol. 2, 1833, p. 580 (Dampara, in Dholbhúm, Bengal, India).

Chars. subsp..—Resembling *Caprimulgus macrurus bimaculatus*, but decidedly larger; ground color of upper parts lighter, more buffy or ochraceous; streaking on the crown less extensive, more confined to the median portion.

Measurements.—Male: ¹ Wing, 208 mm.; tail, 173; exposed culmen, 11.7; tarsus, 16.

Female: ² Wing, 204–214 (average, 209) mm.; tail, 156–162 (159); exposed culmen, 10; tarsus, 18–18.5 (18.3).

Type-locality.—Dampara, in Dholbhúm, Bengal, India.

Geographical distribution.—Northeastern India: North to the North-western Provinces; west to Simla and the central Provinces (Raipur); south to Raipur, Chota Nagpur, and Bengal; and east to Bengal.

Remarks.—There seems to be little doubt that this bird is, as noted by Doctor Hartert,³ a subspecies of *Caprimulgus macrurus*. It is readily distinguishable from all the other forms of the species, excepting *Caprimulgus macrurus nipalensis*, by its very large size. As in other forms of the species, there are two color phases in *Caprimulgus macrurus albonotatus*, though they are not so strongly marked as in *Caprimulgus macrurus macrurus*. One is rather dark with a more brownish or grayish tone both above and below, the other is decidedly lighter and more rufescent throughout.

Measurements of specimens of *Caprimulgus macrurus albonotatus*.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.
					mm.	mm.	mm.	mm.
A.N.S.Phila.21849 ⁴	Male....	India.....	.....	.....	208	173	11.7	16
A.N.S.Phila.21850 ⁴	Female ..	do.....	.....	.....	214	156	10	18
A.N.S.Phila.21848 ⁴	[Female]	do.....	.....	.....	204	162	.....	18.5

⁴ Used in measurement averages on p. 597.

CAPRIMULGUS MACRURUS NIPALENSIS Hartert.

- C[aprimulgus]. *nipalensis* HODGSON, in Gray's Zool. Misc., No. 3, 1844, p. 82 (*nomen nudum*).
- C[aprimulgus]. *nipalensis* HARTERT, Cat. Birds Brit. Mus., vol. 16, 1892, p. 541 (Hodgson MS.) (Nepal).
- C[aprimulgus]. *macrurus nipalensis* HARTERT, Ibis, 1896, p. 373 (Hodgson MS.) (Nepal and the Western Himalayas).

Chars. subsp..—Similar to *Caprimulgus macrurus albonotatus*, but dark markings above bolder and more distinct; head more grayish; lower parts less rufescent, and more strongly barred.

¹ One specimen, from India.

² Two specimens, from India.

³ Ibis, 1896, p. 372.

Measurements.—Like those of *Caprimulgus macrurus albonotatus*.¹

Type-locality.—Nepal.

Geographical distribution.—Nepal; probably also Sikkim, Darjiling, and Bhutan.

Remarks.—This form shares the large size of *Caprimulgus macrurus albonotatus*, and by this alone is separable from all the other subspecies. We have seen no authentic examples, but it is apparently a recognizable race. It was first characterized from Nepal specimens by Doctor Hartert in his account of *Caprimulgus macrurus albonotatus*, in volume 16 of the Catalogue of Birds in the British Museum, 1892, p. 541, and the manuscript name *Caprimulgus nipalensis* Hodgson applied to it, although it was not here formally recognized. The name, however, must date from this characterization, which is perfectly explicit.

CAPRIMULGUS MACRURUS ATRIPENNIS Jerdon.

[*Caprimulgus*] *atripennis* JERDON, Illust. Ind. Orn., 1847, text to pl. 24 (Eastern Ghauts, southern India).

Caprimulgus spilocircus GRAY, List. Spec. Birds Brit. Mus., pt. 2, sect. 1, Fissirostres, 1848, p. 7 (based on *Caprimulgus macrurus* Jerdon, Ill. Orn., text to pl. 24; and *Caprimulgus mahrattensis* Jerdon, Madras Journ. Lit. and Sci., vol. 11, 1840, p. 234 [Jaulnah, India]; idem, vol. 13, pt. 2, December, 1844, p. 143 [Eastern Ghauts]).

Chars. subsp.—Similar to *Caprimulgus macrurus nipalensis*, but much smaller and darker. Resembling *Caprimulgus macrurus macrurus*, but ground color of crown more finely mottled with dark brown, and the dark brown streaks more confined to the median line; white spot on the outer primaries more restricted, that on second quill not forming a complete band, but interrupted at the shaft.

Measurements.²—Total length, 264.2–279.4 mm.; wing, 165.1–190.5; tail, 129.5–152.4; tarsus, 17.8.

Type-locality.—Eastern Ghauts, southern India.

Geographical distribution.—Ceylon, and extreme southern India, north on the western side to Belgaum, and on the eastern side to Godaveri.

Remarks.—This is another race that I have not seen, but it is without much doubt recognizable, and a subspecies, as contended by Doctor Hartert.³

¹ Hartert, Tierreich, Lief. 1, 1897, p. 54.

² Compiled from published measurements given by Blanford (Fauna Brit. India, Birds, vol. 3, 1895, p. 189), Jerdon (Birds of India, vol. 1, 1862, p. 196), Hartert (Cat. Birds Brit. Mus., vol. 16, 1892, p. 543), and Legge (Ibis, 1874, p. 12).

³ Ibis, 1896, p. 372.

KEY TO THE SUBSPECIES OF *CAPRIMULGUS MACRURUS*, BASED ON ADULT MALES.

- a*¹. Larger (wing nearly always more than 200 mm.).
- b*¹. Upper parts with dark markings bolder and more distinct; head more grayish; lower parts less rufescent and more strongly barred.
Caprimulgus macrurus nipalensis (p. 597).
- b*². Upper parts with dark markings less bold and distinct; head less grayish; lower parts more rufescent and less strongly barred.
Caprimulgus macrurus albonotatus (p. 597).
- a*². Smaller (wing nearly always less than 200 mm.).
- b*¹. Upper surface darker.
- c*¹. White spot on primaries smaller, that on second quill (counting from outermost) not forming a complete band; dark brown streaks of crown more confined to median line. *Caprimulgus macrurus atripennis* (p. 598).
- c*². White spot on primaries larger, that on second quill (counting from outermost) forming a complete band; dark brown streaks of crown less confined to median line.
- d*¹. Size larger (wing averaging more than 185 mm.).
Caprimulgus macrurus mesophanis (p. 590).
- d*². Size smaller (wing averaging less than 185 mm.).
Caprimulgus macrurus macrurus (p. 589).
Caprimulgus macrurus yorki (p. 591).
- b*². Upper surface lighter.
- c*¹. Size less (wing usually under 180 mm.). *Caprimulgus macrurus keatsi* (p. 592).
- c*². Size greater (wing usually over 180 mm.).
- d*¹. Larger (wing averaging 193.5 mm.).
Caprimulgus macrurus bimaculatus (p. 595).
- d*². Smaller (wing averaging 185.8 mm.).
Caprimulgus macrurus anamesus (p. 593).

NOTES ON NEOTROPICAL DRAGONFLIES, OR ODONATA.

By EDWARD BRUCE WILLIAMSON,
Of Bluffton, Indiana.

These notes consist of four brief papers relating to agrionines of the genera *Metaleptobasis*, *Palaemnema*, *Telagrion*, and *Protoneura*. While these four papers are distinct and of different characters, it is believed that their publication under one general head will be found to be convenient. The Guatemala material was collected by myself; that from British Guiana and Trinidad by my father, L. A. Williamson, B. J. Rainey, and myself.

1. THREE NEW SPECIES OF METALEPTOBASIS.

As *Metaleptobasis* is now understood ¹ less than a dozen specimens have been described or mentioned in the literature relating to the several species. On March 8, 1912, my father, L. A. Williamson, and I were collecting at a small swamp about $1\frac{3}{4}$ miles west of Cumuto, Trinidad, on the north side of and immediately adjacent to the railroad track. This is a small swamp, near the railroad, surrounded by higher ground, full of logs and grass, and containing fish and alligators. The larger part of the swamp near the railroad is exposed to the sun, and this portion of the swamp apparently has resulted from the fill for the railroad grade. Back from the railroad the swamp is interspersed with small thickets which shade the ground, and at the extreme upper portion it ends in woods through which a small and very muddy creek flows into the swamp. In the afternoon, after several hours at the swamp, we detected for the first time a slender dragonfly in grass, and clinging to small twigs and vines just at the border or slightly back from the border of the swamp and in the shade. Having once found it we could hardly believe we had overlooked it during the earlier part of the day. But a short time could be spent that day looking for them but we succeeded in taking 18 males. Wishing to get females and more specimens Mr. B. J. Rainey and I returned to the swamp on March 10, 1912, and spent the day there. In addition to many other things we took 52

¹ Calvert, Philip P. *Biologia Centrali-Americana*, Odonata, p. 386, November, 1907; Contributions to a knowledge of the Odonata of the Neotropical Region, exclusive of Mexico and Central America, *Ann. Carnegie Mus.*, vol. 6, No. 1, p. 197, October 7, 1909.

males of *Metaleptobasis*, but neither of us were able to find the females, though we went some distance into the woods in several directions. When papering this material a unique male of a very distinct species was detected; and later study of the collection reveals another species, represented by 3 males. This last species is also represented by a single male from British Guiana. Thus of the 70 specimens of *Metaleptobasis* taken about this little swamp in Trinidad, 66 belong to a species (*manicaria*) not known elsewhere; 3 belong to a very closely related species (*mauritica*) known also from British Guiana; and the unique (*brysonima*) is more closely related to *bovillia*, known from Guatemala and Nicaragua, than to any other species. In this connection attention may be called to the fact that 2 species of the genus were added to the known dragonfly fauna of Trinidad by our efforts in collecting a very large series of what, at the time, we presumed was one species. Moreover, on the second day Mr. Rainey collected a unique male of another genus, which would not have been found but for his careful search for *Metaleptobasis*.

METALEPTOBASIS BOVILLA Calvert.

Hitherto known from a single male from Nicaragua and a single female from Guatemala. The female is in my collection. The capture of another male in Guatemala indicates that Doctor Calvert was correct in associating the 2 specimens before him. I caught this male on June 23, 1909, in the swampy palm woods on the left side (as one approaches Puerto Barrios) of the railroad track just back from Puerto Barrios. It was clinging to a vine several feet from the ground. No others were seen, but the careful search, which later experience has shown necessary, was not made.

METALEPTOBASIS BRYSONIMA,¹ new species.

Related to *M. bovillia* and described in the tabulations which follow. It may be separated at once from *bovillia* by the form of the abdominal appendages which are figured for both species.

The following notes were made on the living colors: Eyes bright green beneath, above very dark green in front, with a large posterior red spot (this refers to the dorsal surface of the eyes), the green and red separated by a triangular black area, one side of the triangle being against the vertex. Dorsum of thorax narrowly metallic black, on either side dark flesh red, shading out to paler below and behind. Dorsum of abdomen black, sides dull yellowish; about apical half of 7 and all of 8-10 about the color of the mesepimeron (flesh red).

Described from a single male in my collection taken March 10, 1912, at the swamp described above near Cumuto, Trinidad.

¹ As in the following two species, I am under obligations to Mr. W. E. Broadway, of the Botanic Station, Tobago, who has kindly furnished me with three generic names of plants which occur in the savannahs near Cumuto and elsewhere in Trinidad. *Brysonima* is "a small scraggy-looking tree characteristic of these natural savannahs."

METALEPTOBASIS MAURITIA,¹ new species.

Related to the following species from which it is most readily separated by the shorter abdominal appendages and the form of the apex of abdominal segment 10. Described in the tabulations which follow from 4 specimens in my collection, 3 males from the swamp near Cumuto, Trinidad, March 10, 1912; and 1 male from near Tumatumari, Potaro River, British Guiana, February 9, 1912. This last male was collected in a low, flat area on the right bank of the river just above Tumatumari. On this date this flat was dry, but it showed evidence of being frequently submerged for long periods. The ground was bare over large portions of the surface, and the vegetation was in scattered clumps, confined to a very few species. The dragonfly was taken resting on a leaf near the ground. More careful and intelligent search might have revealed more, but only the one was seen. While the specimen from British Guiana is considerably larger than the Trinidad specimens, I am convinced that they are the same species. The type of *mauritiae* is a male from Trinidad, in my collection.

Paratype.—Cat. No. 18063, U.S.N.M. One of the 3 males from Cumuto, Trinidad, mentioned above.

METALEPTOBASIS MANICARIA,² new species.

Related to *mauritiae* and described in the tabulations which follow. Sixty-six males, all taken at the swamp near Cumuto, Trinidad, on March 8 and 10, 1912, are before me.

The following notes were made on the living colors: Colors generally dull. Eyes beneath light bluish green, above dark green, with a posterior bright orange spot³ which is bordered in front with black (as in the case of *brysonima*, not only these brilliant colors of the eyes fade but the pattern even disappears). Dorsum of thorax narrowly black; mesepisternum pale greenish brown; mesepimeron paler; metepisternum and metepimeron pale yellowish with greenish reflections. Dorsum of abdomen metallic greenish black, below this bluish green, rather dull and obscured; segments 8–10 dull yellowish brown with bluish or greenish traces laterally.

Two specimens in 95 per cent alcohol, one year after capture, are as follows: The colors of the eyes are well preserved, with the orange somewhat paler. The mesepimeron, metepisternum, and metepimeron are about the same color, pale yellowish, but I do not detect the greenish reflections, which are still evident, however, on the apical

¹ *Mauritia* is the generic name of "the tall palm which grows in quantity together on the savannah" (Broadway).

² *Manicaria* is the generic name of "a palm which I have seen in watery positions near Cumuto" (Broadway).

³ This spot is on the posterior portion of the dorsal surface of the eyes; not to be confused with the rear of the head or eyes.

abdominal segments. Segment 7 is apically colored like the segments following it, and on its sides the pale colors extend almost or quite to its base.

Of the total number of this species before me 3 have one mesothoracic horn incomplete or wanting. The last postnodals of 8 specimens were examined; in the front wing the last postnodal was continuous in 6 cases, not continuous in 10; in the hind wing, continuous in 3 cases, not continuous in 13 cases. The type is a male in my collection.

Paratype.—Cat. No. 18064, U.S.N.M. Four of the males from Cumuto, Trinidad, mentioned above, two of which were collected on March 8 and the other two on March 10.

METALEPTOBASIS (?) species.

In the tabulations which follow, a female probably belonging to *Metaleptobasis* is described. I believe this specimen represents an unnamed species, but, in so far as its association with the proper male of possibly several closely related species may be difficult, and as apparently in this genus males are more frequently taken than females, to name this species at this time might result in delay, annoyance, and possible confusion for subsequent authors. The specimen was taken in swampy woods near Rockstone, British Guiana, January 30, 1912.

Comparison of characters of species in the genus Metaleptobasis.

	<i>bovilla</i> , male.	<i>brysonima</i> , male.	<i>mauritita</i> , male.	<i>manicaria</i> , male.	<i>sp.</i> , female.
Length of abdomen (mm.).	37	34	37 (Trinidad). 41 (British Guiana)	37	33
Length of hind wing (mm.).	22	20.5	22 (Trinidad). 24 (British Guiana)	21	21
Labium....	Pale flesh; cleft in median lobe wide, U-shaped, with sides of cleft not parallel.	Flesh colored; cleft in median lobe half as wide as in <i>bovilla</i> , sides parallel.	Pale flesh; cleft in median lobe intermediate in width with two preceding species, cleft widest near the middle, sides not parallel.	Same as <i>mauritita</i> .	Pale flesh; cleft in median lobe short, wide, and rounded.
Labrum...	Shining black.	Light reddish brown, darker basally and laterally.	Brown, paler basally, lateral margins darker.	Pattern similar to <i>mauritita</i> but central area greenish brown.	Shining black.
Rhinarium.	Ultra ash gray, with a basal dark spot on either side of median line.	Very light brown with a dark spot on either side of median line.	Pale dull blue green with a dark spot on either side of median line.	Similar to <i>mauritita</i> .	Black.

Comparison of characters of species in the genus *Metaleptobasis*—Continued.

	<i>bovilla</i> , male.	<i>brysonima</i> , male.	<i>mauritii</i> , male.	<i>manicaria</i> , male.	<i>sp.</i> , female.
Nasus.....	Black; on anterior edge on either side is a shining black ocellus - like spot.	Similar to <i>bovilla</i> .	Dark gray, almost black, with shining black spots as in <i>bovilla</i> .	Dark and dull apple green, almost black in some cases, with shining spots as in <i>bovilla</i> .	Black.
Frons in front.	Obscure pale clay yellow.	Dark, almost black, with a blue green cast.	Obscure dull blue green.	Obscure dull blue green, very dark in some cases.	Dark, almost black, with a blue green cast.
Frons above.	Black.	Black.	Black, or nearly so.	Dark brown, almost black.	Black.
Vertex.....	Black, the merest trace of the orange line between the lateral ocellus and the antenna described by Calvert (Biol. Cent. Amer., p. 386).	Black.	Black, obscurely patterned with slightly paler. ¹	Black or nearly so and obscurely patterned with slightly paler. ¹	Black, with a dull orange, short, wide stripe near each eye, each stripe parallel with the rear of the head in dorsal view.
Gena.....	Pale dull blue green, a round dark spot opposite anterior face of frons.	Blue green, with a narrow dark bar across the gena opposite the anterior face of frons.	Blue green, a round black spot, not quite reaching the eye, opposite anterior face of frons.	Same as <i>mauritii</i> , but dark spot smaller.	Pale blue green, unspotted.
Rear of head.	Pale flesh.	Pale flesh.	Pale flesh.	Pale flesh.	Pale flesh.
Antenna...	Black, second joint pale except extreme apex.	Same as <i>bovilla</i> .	Same as <i>bovilla</i> .	Same as <i>bovilla</i> .	Same, but apical half or third of second segment black.
Prothorax.	Flesh colored, darker and redder above.	Same as <i>bovilla</i> .	Same as <i>bovilla</i> , posterior lobe sometimes black.	Same as <i>bovilla</i> .	Same as <i>bovilla</i> .
Thorax.....	Middorsal stripe metallic green, about 0.5 mm. wide; mesepisternum brown ocher, passing ventrally and posteriorly into pale flesh color on metepimeron.	Same as <i>bovilla</i> .	Middorsal stripe black with but a trace, if any, of metallic green, about 0.5 mm. wide; mesepisternum pale brown, passing ventrally and posteriorly into pale flesh color on metepimeron.	Middorsal stripe metallic green, about 0.25 mm. wide or less, otherwise like <i>mauritii</i> .	Color of <i>bovilla</i> but no middorsal stripe; on outer half of mesepisternum and on suture between mesepimeron and metepisternum is stippling in dark reddish brown, forming 2 diffuse bands.

¹ Possibly the darkest areas on the vertex are, on either side a band running from the lateral ocellus to the eye, its outer end posterior to the antenna; and a shorter band about half as long, behind the first band, from which it is separated by about its own width, this shorter band reaching the eye; the shorter band is subparallel to the longer band anterior to it and is slightly curved, the convex side anterior, while in the longer band the convex side is posterior. These areas or bands are not always discernible. In addition a less defined dark band may sometimes be detected which extends from the inner end of the shorter band, above described, to the eye, this band being parallel to the outline of the rear of the head in dorsal view.

Comparison of characters of species in the genus *Metaleptobasis*—Continued.

	<i>bovilla</i> , male.	<i>brysonima</i> , male.	<i>mauritii</i> , male.	<i>manicaria</i> , male.	<i>sp.</i> , female.
Abdomen..	1 dark flesh colored, darker apically, 2-10 dark brown or black dorsally; pale interrupted basal rings on 3-8; sides of 8 brown, 10 largely brown, 2-6 beneath pale, darker apically, 7-10 beneath light brown.	1-7 similar to <i>bovilla</i> ; 8-10 pale dull brown ocher.	1-7 similar to <i>bovilla</i> ; 8-10 dull brown ocher, basal half of 9 darker; in one specimen basal three-fourths of 8 and basal three-fifths of 9 dark.	Similar to <i>brysonima</i> , but 7 apically more or less the color of 8-10.	Similar to <i>bovilla</i> , but basal rings evident only on 2 and 3.
Legs.....	Pale, tarsal claws not toothed.	Same as <i>bovilla</i> .	Same as <i>bovilla</i> .	Same as <i>bovilla</i> .	Same as <i>bovilla</i> .
Stigma.....	Covering 1 cell; dark brown, paler just against the inclosing veins.	Covering 1 cell or slightly less; brown ocher, paler just against the inclosing veins.	Not quite or covering 1 cell; pale brown, paler just against the inclosing veins.	Same as <i>mauritii</i> ; generally covering 1 cell; brown, paler against the inclosing veins.	Reduced, covering much less than 1 cell; pale brown, paler just against the inclosing veins.
Cubito-anal cross vein from quadrangle.	Not over twice its own length.	About twice its own length.	Same as <i>brysonima</i> .	2-3 times its own length.	More than 3 times its own length.
Posterior wing margin meeting anal vein.	Slightly distal to cubito-anal cross vein.	Same as <i>bovilla</i> .	More distal than in the 2 preceding species; about the length of the cubito-anal cross vein or more.	Same as <i>bovilla</i> .	At cubito-anal cross vein.
Ratio of anterior side of quadrangle to posterior side in front wing.	2:5	2:5	2:5	2:5	1:4
Same in hind wing.	2:3	2:3	2:3	2:3	1:2
Postquadrangular cells to level of intersection of R_4 with M_{1-2} (antennodal cells).	3	3	3	3	3
Postnodals in front wing.	12 (2 wings).	11 (2 wings).	11 (2 wings). 12 (5 wings). 13 (1 wing).	11 (1 wing). 12 (3 wings). 13 (16 wings).	12 (1 wing). 13 (1 wing).
Same in hind wing.	11 (2 wings).	10 (2 wings).	11 (5 wings). 12 (3 wings).	10 (1 wing). 11 (3 wings). 12 (16 wings).	11 (2 wings).

Comparison of characters of species in the genus *Metaleptobasis*—Continued.

	<i>bovilla</i> , male.	<i>brysonima</i> , male.	<i>mauritia</i> , male.	<i>manicaria</i> , male.	<i>sp.</i> , female.
Origin of M_2 in front wing with reference to the post-nodals.	Near 6th (2 wings).	Near 6th (1 wing). Between 5th and 6th (1 wing).	At 6th (2 wings). Near 7th (3 wings). At 7th (3 wings).	At 5th (3 wings). At 6th (13 wings). At 7th (4 wings).	At 6th (2 wings).
Same in hind wing.	Near 6th (2 wings).	At 5th (2 wings).	Near 6th (2 wings). At 6th (4 wings). Between 6th and 7th (1 wing). At 7th (1 wing).	At 5th (5 wings). At 6th (15 wings).	At 5th (2 wings).
Origin of M_{1a} in front wing with reference to the post-nodals.	At 9th (2 wings).	At 8th (1 wing). At 9th (1 wing).	At 10th (2 wings). At 11th (6 wings).	At 9th (2 wings). At 10th (5 wings). At 11th (11 wings). At 12th (2 wings).	At 9th (2 wings).
Same in hind wing.	At 8th (2 wings).	At 9th (2 wings).	At 10th (5 wings). At 11th (2 wings). Between 11th and 12th (1 wing).	At 9th (4 wings). At 10th (8 wings). At 11th (8 wings).	At 8th (2 wings).
Cu_1 in front wing ending with reference to the post-nodals.	At 8th (2 wings).	At 8th (2 wings).	At 9th (6 wings). At 10th (2 wings).	At 8th (2 wings). At 9th (6 wings). At 10th (12 wings).	At 8th (2 wings).
Same in hind wing.	At 8th (2 wings).	At 8th (2 wings).	At 8th (1 wing). At 9th (4 wings). At 10th (3 wings).	At 8th (2 wings). At 9th (9 wings). At 10th (9 wings).	At 8th (2 wings).
Cu_2 in front wing ending with reference to the post-nodals.	At 5th (2 wings).	At 5th (2 wings).	At 6th (2 wings). At 7th (6 wings).	At 5th (2 wings). At 6th (3 wings). At 7th (11 wings). At 8th (4 wings).	At 3d (1 wing). At 4th (1 wing).
Same in hind wing.	At 5th (2 wings).	At 6th (2 wings).	At 6th (2 wings). At 7th (6 wings).	At 6th (2 wings). At 7th (15 wings). At 8th (3 wings).	At 4th (2 wings).

Brief mention may be made of earlier described species which are now referred to *Metaleptobasis*.

M. diceras was described by De Selys from a male with the last 4 segments lost and a female from Para. Calvert¹ refers a single male from Bahia, Brazil, to this species. No other specimens are known. Doctor Calvert figures the mesothoracic horns and the

¹ Calvert, Philip P. Contributions to a knowledge of the Odonata of the Neotropical Region, exclusive of Mexico and Central America, Ann. Carnegie Mus., vol. 6, No. 1, pp. 197-198, October 7, 1909.

abdominal appendages. If he is right in his determination, *dicerus* can not be confused with any of the species I have before me because of the form of the appendages, which, in *dicerus*, have the superiors large and robust in profile view, with the inferiors of apparently simple form and only about half as long as the superiors. De Selys describes *dicerus* as having the mesothoracic horns slender and rather long. I am doubtful if this agrees well with Calvert's male. However, so far as the material before me goes, none of the species agrees with De Selys's description of the color of the head or the proportions of the anterior and posterior sides of the quadrangle.

M. bicornis was described by De Selys from a single female from the Amazon, has been recorded from Colombia by Brauer (1900), and described from an incomplete male, lacking the last 4 segments, by Calvert.¹ As Calvert points out, De Selys's description of the proportion of the anterior to the posterior side of the quadrangle in the front wing is undoubtedly a misprint, and should be 2:5, not 2:3. The color of the head of *bicornis* differs from any material before me. It is not impossible that the type female in De Selys's collection will prove unidentifiable through inability to associate it certainly with the proper male of any one of possibly two or more closely related species.

M. quadricornis was described by De Selys from a single female from Para. In this species there are nearly equal, rather short, conical horns on both the prothorax and mesothorax. The dorsum of the head is black.

M. cornicauda was described by Calvert² from a single male from Bahia, Brazil. It has no thoracic horns, and the superior appendages are robust, with the inferiors about one-third as long and of simple form. It is related to *macilenta*, according to Calvert, who regards *macilenta* as probably belonging to *Metaleptobasis*. *Macilenta* is known only from Rambur's type, a male in De Selys's collection.

2. TWO SPECIES OF PALAEMNEMA FROM GUATEMALA.

In material collected by myself in Guatemala in 1909 are 27 males³ and 2 females of *Palaemnema paulina* (Drury), all taken at El Fiscal, Department Guatemala, June 3-6, except one male taken at Agua Caliente, a few miles below El Fiscal toward Puerto Barrios. (Agua Caliente of my itinerary of 1905 in Guatemala is a small village at some distance from the river; Agua Caliente, as now designated on the railroad from Puerto Barrios to Guatemala City, is a station, marked by a single building, situated on the right bank of the river, at the end of the railroad bridge, and possibly a mile distant from the

¹ Ann. Carnegie Mus., vol. 6, No. 1, 1909, p. 198.

² Idem, pp. 199-200.

³ One of these males, collected on June 6, 1909, at El Fiscal, Department Guatemala, is in the United States National Museum collection.

little village, flanking the Government road over which we traveled by mule in 1905.) The collection also contains a male and female of *P. nathalia* Selys, taken at Gualan, Department Zacapa, the male on June 13, the female June 16, 1909. No *Palaemnemas* were taken by me in Guatemala in 1905, and the number of specimens known from other sources has been very limited. It was therefore deemed desirable to study this material carefully, with the view of determining the variability of certain characters, and especially to describe the female of *paulina* which has not hitherto been known.

I do not recall the circumstances under which the *P. nathalia* at Gualan were taken. I collected at widely separated localities on June 13 and 16, but there is no doubt, I think, that the male and female taken belong to the same species.

On the other hand I have a vivid recollection of the locality where *P. paulina* was found at El Fiscal. For some time prior to June 5, on which date there was a heavy rain in the afternoon at El Fiscal, there had been a continued and severe drought. Within a week after the first rain of June 5 the country had greened up beautifully. In the last stages of the drought all the water used by the Indian family with whom we lived at El Fiscal was carried from a small stream (called a river) flowing in a deep ravine about 1 mile or more north of the village. In places the sides of this ravine were perpendicular or even overhanging. Several times a large and extremely rapidly flying swift was seen here and parrots were often very numerous about holes in certain perpendicular dirt faces. At places the sides rose less abruptly and agaves were very numerous. At several points there were boggy spots on the sides of the ravine, about which grew some of the arums with other lush vegetation. *Hetaerina capitalis* was common in this ravine. The *Palaemnemas* occurred especially about the boggy spots, resting on larger leaved plants near the ground, and flying low and through brush to escape. One of the males, taken June 3, has a small fly in its mouth. The fly is a muscid, apparently one of the pomace flies.

In addition to the several characters mentioned below in which these two species differ, *nathalia* and *paulina* of both sexes may be at once separated by the form of the posterior ridge or keel of the occiput as seen in a direct dorsal view of the head. This ridge is equal in length to the distance between the antennæ, and directly posterior to each antenna is a distinct prominence on either end of this ridge or keel. In *paulina* the ridge is cut abruptly away externally at either end, leaving the prominence with a very distinct angle of about 90°; in *nathalia*, on the other hand, these prominences are low, symmetrical and rounded. I regret that I can not study this character in other species. It has not been mentioned in descriptions but its diagnostic value in the case of *paulina* and *nathalia* can not be overlooked.

In colors *nathalia* is a very much duller insect than *paulina*.

Comparison of characters of Palaemnema paulina and P. nathalia.

	<i>paulina.</i>	<i>nathalia.</i>
Labrum.....	Clear cream with lower half or third shining black, the colors sharply defined.	Bluish or greenish white with lower edge black, a dull violet indefinite band, equal in width to the pale basal area, between the pale area and the black edge.
Clypeus.....	Bluish or greenish white, postclypeus becoming dark with age and eventually black, at least in the male.	Dingy bluish white with the postclypeus, especially near the frons, tinged with violet.
Epicranium above the clypeus.	Shining black with bronze green reflections.	Shining black with bronze green reflections.
Prothorax.....	Colors sharply defined, the dark umber of dorsum of thorax continued on the posterior and median lobes and to a greater or less extent on the anterior lobe as a central spot, the blue (or yellow or greenish) pale antehumeral stripes carried straight across the posterior and median lobes on either side and spreading out over the anterior lobe.	Colors less sharply defined, both as regards contrast in colors themselves and in pattern. Pattern as described for <i>paulina</i> , but the dorsal color is a reddish brown and the lateral pale areas are flesh color with violet and dingy shadings.
Thorax.....	Dorsum dark rich umber; antehumeral stripe blue (or yellowish or greenish in younger individuals); sides blue with violet reflections, especially on the mesepimeron and metepimeron (in younger individuals and in two females these violet areas tend to deepen in color, while the other pale areas are yellowish); a dark stripe on the humeral and second lateral sutures, the latter the wider; mesinfraepisternum and propleuron dark.	Dorsum yellowish or greenish bronze, slightly less in extent than the dark dorsum of <i>paulina</i> ; antehumeral stripes lilac; sides about as in <i>paulina</i> , so far as the limited material goes; mesinfraepisternum dark, but propleuron pale, not dark as in <i>paulina</i> .
Legs.....	Coxae all pale; legs flesh color; femora dark to black superiorly; first tibiae darker than the others, especially inferiorly.	Similar to <i>paulina</i> , but all tibiae the same color, and slightly darker than the last two pairs in <i>paulina</i> .
Abdomen.....	Male dorsum of 1 and 2 black, widest apically; 3-7 with basal cream-colored rings interrupted middorsally on 3; 8 and 9 lilac; 10 black; female similar to the male except last 3 segments; 8 is entirely black, 9 has a large irregular dorsal spot pale dingy yellowish, this spot narrowly separated from the base of the segment in the middorsal line, separated from the apex by its own width, on the sides of the segment produced apically, and separated from the apex by only a narrow margin, widely separated from the lower margin of the segment; 10 and appendages dark; apex of ovipositor clear pale yellow.	Male similar to <i>paulina</i> , basal rings on 3-7 narrower, duller and less produced apically along the lower lateral margin of each segment; 10 apparently with some of the dorsum pale colored; female similar to <i>paulina</i> but the spot on 9 is less sharply defined and is slightly larger.
Length of abdomen (mm.).	Male, 37.5-43.5; average of 10, 39.95; female, 34-35.5.	Male, 32.5; female, 30.
Length of hind wing (mm.).	Male, 27-32; average of 10, 29.45; female, 27-29.	Male and female, 24.5.
Postnodals, front wing.	Male, 21-28 (3 wings have 21; 2, 22; 2, 23; 7, 24; 2, 25; 3, 26; 1, 28), average of 20 wings, 23.85; female, 22-24 (1 wing has 22; 1, 23; 2, 24).	Male, 22-23; female, 22.
Postnodals, hind wing.	Male, 18-23 (2 wings have 18; 3, 19; 3, 20; 7, 21; 3, 22; 2, 23), average of 20 wings, 20.6; female, 20-21 (2 wings have 20; 2, 21).	Male, 19; female, 20-21.

Comparison of characters of Palaemnema paulina and P. nathalia—Continued.

	<i>paulina</i> .	<i>nathalia</i> .
Cu ₁ ending beyond origin of M _{1a} in front wing (i. e., number of marginal cells posterior to Cu ₁ apical to origin of M _{1a}).	Male, 2-9 cells (1 wing has 2; 1, 3; 1, 3.5; 1, 4; 2, 5; 1, 5.5; 1, 6; 5, 7; 1, 7.5; 4, 8; 2, 9), average of 20 wings, 6.32; female, 3-6 (1 wing has 3; 1, 3.5; 2, 6).	Male, 5 and 7; female, 4.5 and 6.5.
Same of hind wing.	Male, 7-13 cells (2 wings have 7; 1, 7.5; 1, 8; 1, 8.5; 3, 9; 1, 9.5; 2, 10; 3, 11; 1, 11.5; 4, 12; 1, 13), average of 20 wings, 10; female, 7.5-10 (1 wing has 7.5; 1, 8; 1, 9; 1, 10).	Male, 11 and 13; female, 9.
Number of cells surmounted by stigma, front wing.	Male, 2-3.5 (5 wings 2; 9, 2.5; 5, 3; 1, 3.5), average of 20 wings, 2.55; female, 2-3 (1 wing 2; 2, 2.5; 1, 3).	Male and female, 2.
Same of hind wing..	Male, 2-3 (1 wing 2; 9, 2.5; 10, 3), average of 20 wings, 2.725; female, 2.	Male, 2; female, 1.5 and 2.

In two front wings and one hind wing of the 10 males of *paulina* carefully studied the cubito-anal cross-vein is midway or slightly closer to the first antenodal; in all the others it is closer to the second antenodal. The unusual condition is due to the more apical position of the first antenodal in these cases, the position of the second antenodal being relatively fixed by its relation to the arculus (some slight variation, as the second antenodal is at or slightly proximal to the arculus). When the second antenodal is proximal to the arculus the result is that the cubito-anal cross-vein is placed relatively nearer the second antenodal. To sum up, variation in this character—the cubito-anal cross-vein nearer the first or second antenodal—might arise from 3 widely different causes: (1) The subquadrangle may be lengthened basally, and the cubito-anal cross-vein may really be placed basally with reference to other wing structures; or (2) the first antenodal may be moved apically or basally, shortening or lengthening the distance between the antenodals; or (3) the second antenodal may be moved apically or basally, lengthening or shortening the distance between the antenodals. Of course one or all of these conditions might be present in the same wing.

All the specimens of *Palaemnema* in my collection have been examined as to the number of antenodals. Variation is shown in this character in 3 front wings and 1 hind wing of males of *paulina*, in each of which there are 3 antenodals in the first series. Two of the front wings belong to the same individual; the other 2 cases are in two individuals. In the case of the 3 front wings the added antenodal is basal to the normal antenodals; in the hind wing it is placed between the 2 normal antenodals. The variation differs therefore

from the condition found normally in *Thaumatoneura* and several calopterygine genera with reduced venation in which the added number of antenodals confined to the first series are apical to the specialized and strengthened 2 continuous antenodals.

Normally the 4-sided subquadrangle is joined by a single short cross-vein (part of A) to the posterior wing margin, but in all the material before me 1 front wing and 2 hind wings of males of *paulina* have this area 5-sided, with 2 short cross-veins to the posterior wing margin. One front wing and 1 hind wing showing this character were the left wings of 1 individual.

The apices of the wings of all the females and of the male of *nathalia* are without trace of dark color. Wings of both sexes except very teneral individuals and the male of *nathalia* show more or less whitish opalescence, especially on the hind wings and especially beyond the nodus. Since the female of *nathalia* shows this opalescence it may be expected in the male, but the single specimen I have shows only a narrow margin of it about the stigma.

The apical brown on the wings of males of *paulina* is ontogenetic; teneral males show no trace of it, and in the most mature specimens I have it is most extensive and darkest in color. My material is largely teneral, and the following data relating to the 27 males indicate this:

Apices of wings without trace of dark color, 13 individuals.

Apices of wings beyond stigma slightly fumose, 6 individuals.

Apices of wings beyond stigma fumose, 4 individuals.

Apices of wings beyond middle of stigma fumose, 3 individuals.

Apices of wings from level of stigma black, 1 individual.

In view of the ontogenetic character of this wing marking it remains to be seen if *angelina*, as determined by Doctor Calvert,¹ is distinct from *paulina*.

Male abdominal appendages.—In the entire series of *paulina* examined there seems to be no noteworthy variation. The superior appendage on its ventro-internal edge is squarely narrowed, at a distance from the apex less than the width of the appendage at this point, for slightly more than half the width of the appendage, the supero-external edge opposite this cut-out being convex and continuous to the apex. The outline shown in most dorsal views differs from Doctor Calvert's² figure 40, therefore, in that the inner subapical emargination is more marked, the inclosed angle being nearly a right angle, rather than a very obtuse angle. In addition to the spine on the supero-external edge of the superiors, as shown in Doctor Calvert's figure, there is on the same edge a similar smaller spine, placed slightly closer to the apex than to the basal spine, the edge between the spines being concave. The basal spine is not quite so heavy as

¹ Biologia Centrali-Americana, Odonata, p. 136, February, 1903.

² Idem, pl. 5.

shown in Doctor Calvert's figure. Viewed in profile the inferior appendage at about its middle on the ventral edge has a distinct prominence, this prominence being opposite the origin of the basal tooth shown on the inner edge of the inferior appendage in Doctor Calvert's figure. In my material this tooth and the area supporting it extending along the inner side of the appendage to its base is pale colored and apparently less chitinized than the remaining basal portions of the appendage. The apex of the lower appendage terminates in a very narrow, suddenly constricted, flattened, thread-like body, shining and horn like, which resembles a claw or hook on the appendage, curved in directly toward the appendage in a semicircle opposed to the curve of the appendage itself. The tip of this small thread-like body is rounded. Opposed to this curved thread-like end of the appendage and opposite its tip is a minute spine on the appendage. This thread-like body is not discernible on all specimens because of the position of the appendages in drying and because of its small size and optical indistinctness. In life it is probably flexible and, in connection with the spine opposite it, is intimately concerned with the coupling of the sexes.

In the single male of *nathalia* the second spine described above on the supero-external edge of the superiors is minute or wanting and the edge is not concave as in *paulina*. The lower edge of the inferiors, seen in profile, is convex at about the middle but has no distinct prominence as has *paulina*. I detect a similar thread-like apical termination as in that species, but the position of the appendages makes it impossible to study this carefully, and I can not see any minute opposing spine as described for *paulina*.

3. A NEW TELAGRION FROM TRINIDAD, WITH A NOTE ON TELAGRION DAECKII BY PHILIP P. CALVERT.

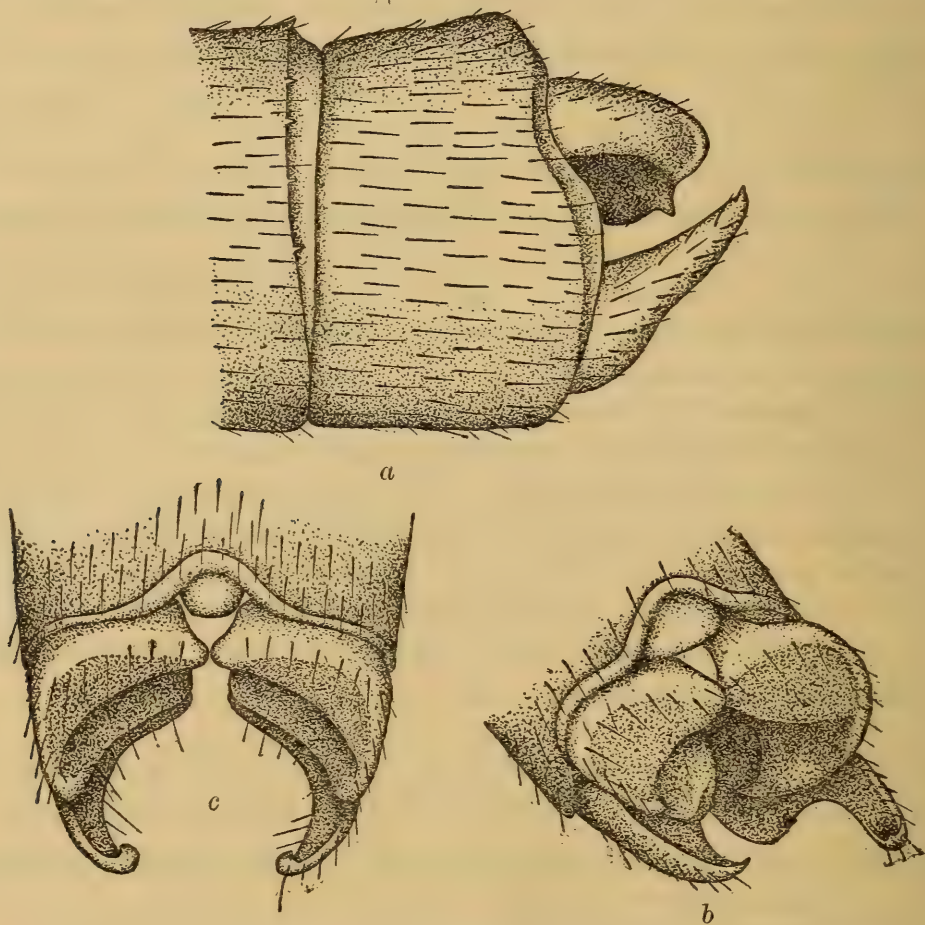
The following is a brief description of a new *Telagrion* collected by Mr. B. J. Rainey in Trinidad.

TELAGRION RAINEYI, new species.

Male.—Length of abdomen, 31 mm.; length of hind wing, 17.5.

Labium pale yellowish, median lobe with a U-shaped cleft for about two-fifths its length. Labrum dark green, very narrowly margined with pale yellow. Clypeus and dorsum of head black, marked as follows: A median yellow spot and on either side a smaller spot between clypeus and frons; occiput, on either side of the occipital ridge behind the ocelli, dull orange, separated from the eyes by a black line; through this orange is a dull black band, about one-third as wide as the orange at the eyes, and extending from the occipital ridge to the eyes, nearly parallel to the rear of the head; overlying the outer end of this black band and the yellow adjacent to it anteriorly are blue

postocular spots. The occipital yellow inclosed between the vertex, the black band above described, and the eye appears as a triangular yellow spot on either side; the apex of the triangle is opposite and separated from the lateral ocellus, and the base of the triangle is parallel to the eye, from which it is narrowly separated by black. That these yellow spots are in reality a part of the larger occipital yellow area, traversed by the black band above described, is evident only after careful examination. On the rear of the head below this yellow occipital area is a transverse broken black line, below which



LATERAL, DORSAL, AND OBLIQUE VIEWS OF THE MALE APPENDAGES OF *Telagrion raineyi*.

the rear of the head is pale yellowish. Gena above the labrum-clypeus suture black, below pale yellowish. First joint of antenna black, about two-thirds length of the second joint, which is light brown, dark brown at apex. Eyes dull green, brown above, paler below.

Thorax below pale yellow. Prothorax dark green above, posterior lobe laterally pale yellow, hind border low, rounded, entire. Mesepisternum brownish green; overlying this ground color on either side a bright pale blue antehumeral stripe, this stripe about one-third the width of the mesepisternum, of uniform width, and straight. Mesepimeron golden and green indefinitely. Metepisternum blue, paler than the antehumeral stripe, and with pale yellowish and greenish

showing through. Metepimeron flesh colored, its posterior and lower fourth (a triangular area) bright yellow as though overlaid with pigment, traces of green showing in the yellow. Coxae and legs pale yellow, spines short and sparse, dark brown; tarsal claws light brown, darker at apex, a minute tooth present.

Abdominal segment 1 brown above in median line, sides above greenish blue, basally and below light yellow; 2 brown above, darker apically, sides above greenish blue, below light yellow; 3-8 black above, 3-5 with greenish reflections, brightest on 3 and successively duller on following segments; interrupted basal rings on 3-7, narrower and complete on 8, greenish blue on 3, pale yellowish on 4-8; 3-7 greenish yellow beneath, brighter on the proximal segments, becoming duller, darker and obscured on the distal segments; dorsal color carried on the sides apically of 3-6 as lateral spots; sides of 7 largely and of 8 entirely dark; 9-10 bright light blue; superior appendages brown, inferiors pale flesh.

Stigma very dark brown, sides subequal, oblique, covering less than one cell. Quadrangle of front wing with ratio of anterior to posterior side 2:5; of hind wing 2:3. Postnodals, front wings 10, hind wings 8 or 9. Arculus at second antenodal. Posterior wing margin meeting A slightly distal to cubito-anal cross-vein in front wing, and at the cubito-anal cross-vein in hind wing. R_s arising from the vein of the nodus; M_3 in front wing arising from almost the same point, in the hind wing very closely to the vein of the nodus but appreciably proximal to it; in all four wings R_s and M_3 closely approximated at the first cross-vein between them and widely separated from M_4 at the same point. M_2 in front wing arising just proximal to fifth postnodal, in hind wing just proximal to fourth postnodal. M_{1a} arising in front wing at eighth postnodal, in hind wing at seventh or eighth. Cu_1 in front wing terminating on a level between fifth and sixth postnodals or at the sixth, in the hind wing at about the sixth; Cu_2 in front and hind wings terminating at the third postnodal.

Described from a single male in my collection taken March 10, 1912, at a small swamp near Cumuto, Trinidad, described on page 601 of this paper, by Mr. B. J. Rainey, to whom I am indebted for this and many more dragonflies, and for whom I take pleasure in naming the species.

The following brief notes on colors made from the freshly killed insect will give some idea of its peculiar beauty when alive. Dorsum of thorax black, a vivid ultramarine blue line just above the humeral suture. Below this blue line and all of the mesepimeron dark dull green; metepisternum largely vivid emerald; metepimeron pale lemon yellow. Eyes beneath emerald, above Nile green; vivid ultramarine irregularly rounded postocular spots. Legs pale yellow, translucent. Abdomen: apex of 1, all of 2 and base of 3 laterally vivid blue as on thorax and postocular spots; sides of 3-7 yellowish;

dorsum of 3-8 black, little if any metallic; 9-10 bright sky blue, unmarked.

My reasons for referring this insect to *Telagrion* are the same as stated by Calvert in describing his *T. daeckii*,¹ in which paper the venation of both *T. daeckii* and *T. longum* Selys is figured. The blue postocular spots of *raineyi* are likely to prove evanescent in dried material. From the described species of *Telagrion*, *raineyi* is distinct by many characters. *T. fulvellum* Selys and *T. inversum* Selys have the abdomen reddish, and in these 2 species and in *longum* the last 3 segments are red or reddish yellow. *T. mecistogastrum* Selys is a larger dragonfly, with the abdomen of the male 50-52 mm. in length. *T. daeckii* has the apex of 7 and 8-10 pale blue.

The following notes on *Telagrion daeckii* by Dr. Philip P. Calvert have been added to this paper at my request:

TELAGRION DAECKII Calvert.

The recently killed male shows the following colors when compared with the original description:² Eyes blue above, becoming pale greenish below; the blue of the head, except the labrum, is mixed with greenish and hence not so pure as that of labrum, thorax, and abdomen; prothorax with a transverse line near the hind dorsal margin; mid-dorsal thoracic carina narrowly blue, dividing the median black stripe longitudinally; metallic green on abdominal segment 7 ending posteriorly in three prolongations, one mid-dorsal, the other two wider and infero-lateral.

In the recently killed female the eyes are pale olive above to pale green below, with two horizontal blackish stripes running from anterior to posterior margin of the eye, the upper stripe at about one-fifth, the lower at two-fifths the eye-height from the upper surface; these stripes sub-equal in width to the pale color which separates them. Heads generally paler and a little more greenish than in the male, this especially true of the labrum. Thorax pale olive green, with black markings as in the male, almost white on the sides inferiorly. Dorsum of abdominal segments 1-8 dark metallic green, widened just in front of the hind end of 2-6 and almost interrupted at the base of 3-7; sides of 1-6 pale green, of 7 and 8 and all of 9 and 10 (except a transverse dorsal basal black stripe or line on 9) pale blue, paler than the same segments of the male.

Appendages one-third as long as 10, pale bluish. Genital valves not reaching farther than the level of the middle of 10, their "palpi" barely extending beyond the level of the hind margin of 10. A stout vulvar spine on the hind ventral end of the sternum of 8. Hind margin of prothorax shaped almost as in the male, perhaps a trifle more produced dorsad.

Abdomen, 32.5-31.5 mm.; hind wing, 21.

Pairs of this species were seen flying together, the male clasping the female with his appendages, the bodies of the two forming an almost continuously straight line, moving rather slowly and stately among the *Pontederia* and *Nymphaea* (*Castalia*) near the banks of the mill pond at Malaga, New Jersey, June 27 and July 2, 1913.

4. SOME STUDIES OF PROTONEURA.

In 1860 De Selys brought under his new *sous-genre* *Protoneura* 3 species—*capillaris*, *tenuis*, and *sancta*. The first considered and best known, *capillaris* Rambur, must be regarded as the type of the

¹ Ent. News, vol. 14, p. 38, February, 1903.

² Idem, p. 36, February, 1903.

genus. In 1886, in his Revision du Synopsis des Agrionines, the American agrionines lacking Cu_2 were considered a *genre Protoneura*, 2 subgenera, *Microneura* (with long legs with long and numerous bristles) and *Protoneura* (with short legs and moderate, less numerous bristles) being recognized. Under this last, 10 species are described, and a careful grouping of the species, based on venational characters, is worked out. These groupings serve admirably as an aid in the identification of species, but, as might be expected, larger material shows that in a very few details they are artificial. For example, the very different wings, figures 4 and 7 of plates 41 and 42, would fall together; and figure 10, plate 42, combines characters in such a way as to exclude it from both of De Selys's groups.

Doctor Calvert¹ describes (or redescribes) 6 new species, bringing the Central American species up to 7, for which 7 species groupings similar to De Selys's, but amplified by other venational and other than venational characters, are given. This summary covers briefly about all that has been written on the relationships within the genus of the 16 known species.

The study of British Guiana material collected by B. J. Rainey and L. A. and E. B. Williamson led to a study of the groupings within the genus in relation both to the known species and to new species in this material. The conclusion has been that groups of generic rank are recognizable, and that it is desirable at this time to separate *Protoneura* into 4 genera. Venational differences between closely related agrionine genera are much more marked in the legion *Protoneura* than in the legion *Agrion*, for example. In the present paper *calverti*, *corculum*, and *amatoria* (see figs. 1, 2, and 3, pl. 41), for example, are considered congeneric, though they differ in two striking venational characters—the proportions of the 3 antenodal costal spaces,² and the ending of Cu_1 . In the characters of Cu_1 *corculum* is like *calverti*; in its antenodal costal spaces it is like *amatoria*. If *calverti* and *amatoria* were separated generically the question of the generic position of *corculum* would be in doubt, and two decisions, in the absence of other determining factors, would be possible: One of the two characters could be regarded as the more important and *corculum* could be associated generically with one or the other species; or a new genus could be erected for *corculum*. That is to say, with our present knowledge, the existence of the species *corculum*, having one venational character of *calverti* and another venational character of *amatoria*, makes the generic separation of *calverti* and *amatoria* impractical. Were the number of

¹ Biologia Centrali-Americana, Neuroptera, pp. 140–145, April, 1903, and 394–397, Nov., 1907.

² The first antenodal costal space is the space from the wing base to the first antenodal; the second antenodal costal space is the space between the antenodals; and the third antenodal costal space is the space from the second antenodal to the nodus.

species involved large, and were such possible new genera not monotypic, added convenience might permit the erection of such new genera; at the present time there seems no warrant for such a minute breaking up of the genus.

The four genera recognized in the present study are described in the following key and tabulation of venational characters. They are as follows:

1. *Protoneura*; type, *capillaris* Rambur.
2. *Epipleoneura*, new genus; type, *lamina*, new species.
3. *Psaironeura*, new genus; type, *remissa* Calvert.
4. *Epipotoneura*, new genus; type, *nehalennia*, new species.

The new generic names are suggestive of the manner of flight of these insects. In their compounding and in the selection of specific names for the six new species described in this paper I have had the advice of Prof. J. B. Parker.

In agrionine wings generally, and in those with reduced venation especially, any shifting of one of the larger veins results in other striking readjustments of other parts. Consequently in such wings as *Protoneura calverti*, for example, where the maximum reduction of American agrionines is reached, there is a relative fixity of parts, which in a more complex wing might shift position with but little effect on adjoining parts. For example, the postnodals generally have well-defined descending cross veins with one of which M_2 bears a definite relation.¹ The origin of M_2 is thus, when once fixed, pretty rigidly held in its place. When one part or character of a wing is located or described by reference to another part, and variation appears, it may be impossible or difficult to tell which part has shifted. For example, variation in the position of the cubito-anal cross vein relative to the first antenodal may result from the shifting of either one or both of the two veins. A series of wing photographs of a species, enlarged to the same scale, would enable one to determine the definiteness or instability of the position in the wing of the cubito-anal cross vein, the antenodals, the arculus, the nodus, and other parts. Such a study should be made in the interests of accuracy in defining the position of these parts. In tabulating wings I have noticed some shifting of the cubito-anal cross vein and both antenodals, and have detected no instability in the arculus or nodus. In one species it was noticed that, when the second antenodal is close to the arculus, the upper limb of the arculus is shorter than when the antenodal is more proximal.

¹ Compare the definite and normal bracing of these parts in *calverti* (fig. 1), for example, with the weak and unusual arrangement shown in the front wing of *remissa* (fig. 9), pls. 41 and 42.

KEY TO THE GENERA AND SPECIES.

- a*¹. Wings narrow, width about one-seventh the length or less; first antenodal costal space longer than the third, and about twice or more the second; R_s arising at the subnodus, M_3 proximal; M_2 arising at or just proximal to the fifth postnodal in the front wings, at or just proximal to the fourth in the hind wings; M_3 ending distal to the stigma.....*Protoneura*.¹
- b*¹. Cu_1 ending against or at the termination of the cross vein descending from the subnodus.²
- c*¹. Wings extremely narrow, the width about one-eighth the length; base to nodus over one-third the wing length and equaling the distance from the nodus to beyond the sixth postnodal; first antenodal costal space nearly equaling the other two.....*calverti*.
- c*². Wing width about one-seventh the length; base to nodus about one-third the wing length and equaling the distance from the nodus to beyond the fifth postnodal; first antenodal costal space only slightly longer than the third.....*corculum*.
- b*². Cu_1 produced beyond the cross vein descending from the subnodus; otherwise like *corculum* above.³ The Central American species may be separated as follows:
- c*¹. Inferior appendages of the male as seen in profile with an acute superior tooth, or the inferiors longer than the superiors; dorsum of thorax of female predominantly black, or mesostigmal spine wanting.
- d*¹. Male and female thoracic dorsum predominantly black; female with mesostigmal spine present.
- e*¹. Abdominal segments 3-7 of male with small dorsal basal blue spots; female not separable from the next species.....*cupida*.
- e*². Dorsum of abdominal segments 3-7 of male basally three-fourths or more red; female not separable from the preceding species.....*amatoria*.
- d*². Male and female thoracic dorsum predominantly orange; dorsum of abdominal segment 3 of male with basal half or more yellow, 4-7 with very narrow basal rings (or wanting on 5-7); female without mesostigmal spine.....*aurantiaca*.
- c*². Inferior appendages of the male without an acute superior tooth, abdominal segments 3-7 with deep yellow narrow basal rings; female without mesostigmal spine.....*cara*.

¹ *Protoneura peramans* Calvert from Guatemala is known to me only from descriptions and I am not certain of its generic position. Specifically it may be recognized at once by the following characters: Abdomen, male 42-43 mm., female 36-37 mm.; hind wing, male 23-24 mm., female 25.5-27 mm.; R_s arising at the subnodus, M_3 proximal; Cu_1 produced beyond the cross vein descending from the subnodus; M_2 arising nearest the sixth or seventh postnodal in the front wings, nearest the fifth in the hind wings.

² *P. paucinervis* Selys and *P. exigua* Selys probably belong here, but are known to me only from descriptions which do not enable me to determine their relationships to *calverti* and *corculum*. Some specific characters of the 4 species are discussed under *calverti*.

³ Four South American species may belong under *b*² under *a*¹, or more probably they belong in *Epiptoneura* under *b*¹ under *a*². The 4 species may be briefly discussed:

ephippigera Selys.—Male. Thorax above and laterally, excepting the metepimeron, shining black; abdomen 35-37 mm., hind wing 20-22 mm.; female not known; South America.

humeralis Selys.—Female only known; considered by De Selys as possibly the female of *ephippigera*; mesepisternum and mesepimeron black with a yellow humeral line; posterior border of prothorax with a V-shaped excavation; abdomen 28 mm., hind wing 20 mm.; South America.

tenuis Selys.—Not well described and known only from De Selys's notes on 3 specimens from the Amazon. The original description (1860) and the later note (1886) have little in common; abdomen 26 mm., hind wing 16 mm.

capilliformis Selys.—Male. Mesepisternum and mesepimeron black, with a fine, obscure, incomplete line on the middorsal carina; abdomen 27 mm., hind wing 16 mm.; female not described, though, to De Selys's original Brazilian record, Calvert adds 3 males, 1 female (Odonata of the Neotropical Region, Ann. Carnegie Mus., p. 212).

- a*². Wings not so narrow, the width one-sixth the length or more; first and third antenodal costal spaces about equal, the first less than twice the second; distance from base to nodus one-third the wing length or slightly less.
- b*¹. *R*_s arising at the subnodus, *M*₃ proximal; *Cu*₁ produced beyond the cross vein descending from the subnodus.....*Epipleoneura*.¹
- c*¹. *M*₂ arising at the third postnodal in the hind wings.
- d*¹. *M*₂ arising at the fourth postnodal in the front wings; the second antenodal costal space shorter than the other two.....*incusa*.
- d*². *M*₂ arising at the fifth or distal to the fourth postnodal in the front wings, the 3 antenodal costal spaces subequal.....*fuscaenea*,
- c*². *M*₂ arising midway between the third and fourth or proximal to the fourth postnodal in the hind wings, at the fifth or more distal in the front wings, the second antenodal costal space shorter than the other two.....*lamina*.
- b*². *R*_s arising distal to the subnodus, *M*₃ proximal, at or distal to the subnodus, or *R*_s and *M*₃ joined at their origin into a single vein arising at or distal to the subnodus.
- c*¹. *Cu*₁ ending at the cross vein descending from the subnodus, the three antenodal costal spaces about equal.....*Psaironeura*.
- d*¹. Dorsum of thorax and last abdominal segments with much red or yellow.
- e*¹. Superior appendages of the male subcylindrical, the inferiors terminated by a small, blunt, curved point.....*tenuissima*.²
- e*². Superior appendages of the male forked, the inferiors without a point.
cerasina.
- d*². Dorsum of the thorax and last abdominal segments with little or no red or yellow.
- e*¹. Abdomen of female 31 mm., 8 and 9 black; hind wing 19–20 mm...*remissa*.
- e*². Abdomen of female 26 mm., 8 and 9 with basal articulations and the apex of 9 pale; hind wing 19 mm.....*sancta*.³
- c*². *Cu*₁ produced beyond the cross vein descending from the subnodus; *M*₂ arising at the fifth postnodal in the front wings, at the third or proximal to the fourth in the hind wings; first and third antenodal costal spaces about equal, the second much shorter, but more than one-half the third; stigma long and narrow, more than twice as long as wide.
Epipotoneura nehalennia.

The discussion of various species collected follows.

PROTONEURA CALVERTI, new species.

Length of abdomen, male 32–34 mm., female 27–29; hind wing, male 17.5–18.5 mm., female 18–19.

Head.—Male. Shining black; labium pale flesh colored; genae bright yellow; 4 duller yellow spots across the head, 1 at the base of each antenna, and 2 on the frons in front; rear of head black.

Female. Black; dorsum with metallic green and violet reflections; labium pale flesh; genae almost white, greenish tinged; anteclypeus with 3 pale spots, obscure or wanting; 4 spots across the head as in the male, but larger and clear pale yellow.

¹ See note 3 on p. 619.

² *Tenuissima* Selys from the Amazon is known to me only from description; both sexes are known. In coloration it is scarcely distinguishable from *cerasina*.

³ Only the female of *sancta* Hagen from Brazil is known, and this to me only from descriptions.

Prothorax.—Male. Black; a large orange (red in life) spot on the middle lobe, slightly narrower at the middle and divided by the merest line of black; hind lobe slightly emarginate at the center.

Female. Black; a light yellow spot on the side of each lobe, forming an interrupted lateral stripe, which is continued onto the mesothorax by a spot on the mesothoracic lamina; hind lobe convex.

Thorax.—Male. Black; mesepisternum with a large triangular orange (red in life) spot below; this spot is about half the length of the mesepisternum and below attains nearly the full width of the mesepisternum, reaching the humeral suture and separated from its fellow on the opposite side narrowly by black in the middorsal line; the black inclosed between the orange spots is triangular in shape, the apex below; an isolated, short and wide band of pale bluish on the metepisternum, surrounding the metastigma; metepimeron pale bluish below for its entire length, the pale encroaching most on the black near the middle of the second lateral suture, which however is not reached by the pale area; metasternum pale flesh, a black transverse band just posterior to the third coxae.

Female. Black; middorsal carina and a narrow humeral stripe pale yellow, the latter more or less interrupted above at one or two points; metepisternum with a flesh colored or pale yellow area similar to the same area in the male but more extensive; below similar to the male. No mesostigmal spines or processes.

Abdomen.—Male. Black; 1 and 2 each with a lateral, quadrate, pale blue spot; ventral edge of sides of segments 7–9 yellowish, wider on 8, very narrow on the other two; 3–6 very long and slender, 4–6 each slightly longer than 3; these 4 segments make up over three-fourths the total length of the abdomen. Appendages black, the superiors brown at the middle.

Female. Black; 1–2 similar to the male; very narrow basal rings on 3–6; a narrow ventral edge of yellowish on sides of 6–9, wider on 8 and 9. Genital valves slightly exceeding 10, the long slender palps slightly exceeding the conical black appendages, which are shorter than 10.

Legs.—Male. Coxae and the extreme base of femora flesh colored; otherwise all black.

Female similar to the male, but basal half (first legs) to two-thirds (last legs) of the femora pale, the pale area with a median brown patch.

Wings clear and shining; stigma black in the male, dark brown in the female. The 3 antenodal costal spaces of the front wing of a male are in length, respectively, 6, 3, $3\frac{1}{2}$ in units of an eyepiece micrometer; of a hind wing, $5\frac{3}{4}$, 3, 3. In the front wing the total, $12\frac{1}{2}$, reaches from the nodus almost to the eighth postnodal; in the hind wing the total, $11\frac{3}{4}$, reaches to just beyond the seventh postnodal. In the front wing of a female the spaces measure 5, $2\frac{3}{4}$, $3\frac{3}{4}$;

the total, $11\frac{1}{3}$, reaching from the nodus to just proximal to the seventh postnodal. The spaces of the hind wing measure 5, $2\frac{2}{3}$, $3\frac{1}{2}$; the total, $10\frac{5}{6}$, reaching from the nodus to just distal to the sixth postnodal. In the 25 wings of this species tabulated as to various characters, the stalks of the sectors of the arculus were studied but not tabulated. In 2 front wings and 2 hind wings only short stalks were present, but in all other cases the stalk of the sectors was long or very long—the longest detected in all the wings of the various species tabulated. It is possible that this character should have been added to those tabulated.

Described from 16 males and 6 females, Cashew Creek, Tumatumari, British Guiana, February 8, 9, and 11, 1912, and 4 males, 1 female, small creek just above Potaro Landing, British Guiana, February 10, 1912. Type, a male, and allotype, a female from Tumatumari, February 8, in my collection. Named for Dr. Philip P. Calvert, whose leadership in systematic American Odonatology for 20 years has won the gratitude and admiration of all students of dragonflies.

Paratypes.—Cat. No. 19214, U.S.N.M. A male and a female from Tumatumari, British Guiana, February 9, 1912.

Cashew Creek is a small sluggish stream, during low-water stage 2 to 6 feet wide, flowing in a mud bed through woods. During low-water stage it is the first flowing water entering Potaro River above Tumatumari on the same side of the river. Just above Potaro Landing is a similar smaller and more shaded stream. In shade this species is all but invisible on the wing. As the males came out in the sunlight, to flutter almost motionless near the water's surface, the red thoracic spots would suddenly appear like tiny flames to attract the attention of the collector. Usually some time elapsed before the rest of the insect could be discerned and its position determined. When they moved the direction of flight could rarely be seen. After some experience with them I became more adept in locating them over the water and could more quickly distinguish the various parts of the body. But a hurried collector, and one unappreciative of the phantomlike character of some of the slender, shade-frequenting tropical agrionines, might have passed up and down the creek many times without detecting the presence of this beautiful and graceful insect. Twice in Trinidad at different small streams I caught the flame-flash of the red-spotted thorax of this or a similar species, but in neither case was I able to obtain a second glimpse of the insect itself.

The female oviposits in submerged leaves, the apex of the abdomen brought almost directly beneath the wing bases, the first 4 segments held aloft and the last 6 segments directed almost vertically downward, in a position suggestive of an ovipositing ichneumon-fly, *Thalessa*.

Of the four species, *paucinervis* Selys, *exigua* Selys, *corculum* Calvert, and *calverti*, both sexes are known. The first two species, from Brazil, are known to me only from descriptions. *Paucinervis* is, to judge by color, closely related to *corculum*, but it remains to be seen whether its venational characters are those of *corculum* or *calverti*. Venationally the same is to be said of *exigua*, in which the thoracic pattern (little black and similar in the two sexes) and the shorter inferior appendages of the male suggest an altogether different relationship. Specifically the 4 may be separated as follows:

<i>Male</i> .—Dorsum of thorax largely black, with large, isolated, trangular red spots on lower half.....	<i>calverti</i> .
Dorsum of thorax largely yellow or red.	
This red or yellow isolated on dorsum.....	<i>corculum</i> .
This red or yellow continuous with pale lateral areas.	
Mesepimeron with black.....	<i>paucinervis</i> .
Mesepimeron without black.....	<i>exigua</i> .
<i>Female</i> .—Thorax largely orange.....	<i>exigua</i> .
Dorsum of thorax largely black.	
Metepimeron with black markings.....	<i>calverti</i> .
Metepimeron without black.	
Metepisternum with some black above.....	<i>corculum</i> .
Metepisternum without black above.....	<i>paucinervis</i> .

PROTONEURA CORCULUM Calvert.

Morales, Guatemala, May 27, 1909, 3 males. This is the second record for this species, the original material, 2 males, 1 female, having been taken at Livingston, Guatemala. The pale dorsal thoracic color is red, not pale blue as described. For a discussion of relationships, see under *P. calverti*.

PROTONEURA AMATORIA Calvert.

Morales, Guatemala, May 27, 1909, 1 male; Los Amates, June 21, 1909, 5 males, 2 females.

Costa Rica: Rio Tizate, south of Turrucars, December 22 and 23, 1909, Calvert and Tristan, 21 males. A pair of the specimens from Los Amates is deposited in the United States National Museum.

Trinidad: Diegomartin River, near Port of Spain, February 29, 1912, 2 males, 1 female. Diegomartin is a small stream, at low-water stage with much of its bed dry. Like other hill streams about Port of Spain, it is very easy to follow the stream's bed, as the water is generally shallow and the bottom hard. Clumps of bamboo grow on the immediate banks at many places along Diegomartin, and below the mass of tough fibrous roots which form a vertical bank are frequently pools of deeper water. *Amatoria* was taken in the shadow of these masses of bamboo roots. Its capture in Trinidad, far from where I collected the types in Honduras, was indeed a surprise.

Doctor Calvert has made the following notes on living Costa Rica material:

Male: Eyes bright red in uppermost third, brown in middle third, pale green in lowermost third, these three colors marked off distinctly from one another in horizontal bands; one black pseudopupilla visible in each band, but less distinctly in the brown. Body colors red, black, and yellow, the last as a transverse median line on frons, a narrow margin to the free edge of the labrum, genae, labium, most of metapleura, pectus, legs, sides, and ventral surface of segment 1, and ventral edges of tergites of 2-9. Female: Eyes colored as in the male but the red less bright and less extensive; no red on the rest of the body, which is dark brown (thorax) and black (abdomen), marked with yellow. This species flew along the banks, close to the water, where it was shallow and not very swift. The male and female flew together, the male holding the female, which oviposited in submerged leaves fallen from the trees overhead.

The variation in the extent of red on the mesepisternum of the male is very great and is apparently independent of locality, Doctor Calvert's material from one locality in Costa Rica showing all variations. In the darkest phase the antehumeral red area at its widest point is less than half as wide as the black area lying between it and the middorsal carina, and is separated from the antealar red spots by a distance about equal to the width of the mesepisternum. Three of Doctor Calvert's 21 males show this pattern. Thirteen males are about the pattern shown in figure 15 (pl. 43.) Five have the antehumeral and antealar red joined, in two cases the red constricted at the point of joining, while in the remaining three this point is entirely obliterated, the broad red antehumeral stripe extending from the wings to and onto the prothorax, completely isolating the oval-shaped middorsal black, which, on either side of the middorsal carina, occupies an area on the mesepisternum about equal to the red. The specimens from Trinidad are colored like the 13 Costa Rica males.

PROTONEURA CUPIDA Calvert.

Los Amates, Guatemala, June 19, 1909, 1 male, along Rio San Francisco, a small stream 10 to 20 feet wide.

PROTONEURA CARA Calvert.

Agua Caliente, Department of Santa Rosa, Guatemala, June 2, 1909, 2 teneral males; Gualan, Guatemala, June 14, 1909, 1 male.

PROTONEURA AURANTIACA Selys.

Los Amates, Guatemala, June 21, 1909, 5 males, 1 female, along a small wet-weather stream in woods. One of the male specimens is deposited in the United States National Museum.

Some doubt existed as to the identification of *aurantiaca*,¹ so a male was sent to Monsieur Severin for comparison with the De Selys material. Doctor Ris reported as follows:

There are in the Selys collection two specimens under this label: (1) Bears a label with *aurantiaca* canceled and *crocea* written in Selys's hand, and a second label with *paucinervis* alone. This specimen is clearly different from Mr. Williamson's specimen

¹ See Calvert, *Biologia Centrali-Americana*, Odonata, p. 143, April, 1903.

aurantiaca from Los Amates. (2) *P. aurantiaca*, Panama, 2 green labels; this specimen is certainly Mr. Williamson's species, though having the black bands of the thorax somewhat narrower; the appendages are the same.

The female of *aurantiaca*, not previously known, is described below.

Length of abdomen, female, 27 mm.; hind wing, female, 18 mm.

Head similar to male, with the following exceptions: Pale areas in front slightly more extensive, the labrum with the lower third pale, not entirely black as in the male. The geminate orange spot on the dorsum of the frons at its anterior edge in the male is entirely wanting in the female. Thoracic markings similar in the two sexes, but the dark markings more extensive in the female; especially true of the middorsal stripe, which is about twice as wide as in the male. In the female, as might be expected, the pale colors are less brilliant, especially on the lower part of the thorax and the legs. No mesostigmal spine.

Abdomen black above, a narrow basal ring on 3; 1-7 with sides above dark and lower half pale; 3 and 4 apically encircled with dark; 8 and 9 each with a lateral pale spot; 10 black. Genital valves reaching the end of 10, the long slender palpi exceeding the conical short appendages which are shorter than 10.

PROTONEURA CAPILLARIS Rambur.

This, the type of *Protoneura*, is found only in Cuba, where no other species of the genus are known to occur; mesepisternum and mesepimeron (the latter not entirely in the young) black or violet-black; male abdomen with segment 3 about five times as long as 2, and the basal fourth dorsally blue; 4-6 with pale basal rings; 7 blue with an apical brown ring; 8-10 black, a little yellow on the sides; female abdomen bronze black, 3-7 with pale basal rings and larger black apical rings; abdomen, male 30-30.5 mm., female 25-26 mm.; hind wing, male 16.5-17 mm., female 17.5-18.5 mm.

In the key to genera and species *capillaris* will fall in b^2 under a^1 . It may be separated at once from the Central American species falling under the same section by the unmarked black or violet-black mesepisternum.

I am indebted to Doctor Calvert for the loan of the left front and hind wings of a male from Cuba, collected by C. L. Wright, in the Academy of Natural Sciences of Philadelphia. Doctor Calvert also sent me a sketch of the basal parts of the right wings of the same specimen.

EPIPLEONEURA LAMINA, new species.

Length of abdomen, male 29-31 mm., female 26.5; hind wing, male 18-19 mm., female 18.

Head.—Male and female. Black above with green reflections; labium pale flesh; lower third of labrum dull pale yellow; anteclypeus and frons below in front light yellow, continuous with the genae,

which are green against the eyes; a triangular greenish yellow spot, surrounded with black, in front of each antenna and on the frons in front.

Prothorax.—Male and female. Above dark shining green; sides brown, darker against the green, paler below; beneath pale flesh; hind lobe low, convex.

Thorax.—Male and female. Dark shining green above, including the mesepisternum and mesepimeron and the upper end of the metepisternum; a very short and narrow superior brown humeral stripe; sides below the green area very pale brown, almost flesh, passing into pale flesh beneath; the pale area of the metepisternum more or less definitely edged with dark.

Abdomen.—Male. Above black, the basal segments with green reflections; obscure, scarcely evident brown basal rings on 3–7; apical articulation of 7 pale; apical third or fourth of 9 pale in life (pale blue?), in dried material dark dull brown; sides dark, shading below into the obscure yellowish brown of the under parts; appendages black.

Female. Similar to male; pale area of sides more extensive (dorsal black narrower); apical articulations of 7–8 pale. Genital valves slightly exceeding 10, the long slender palpi reaching the end of the conical appendages which are shorter than 10.

Legs.—Male and female. Coxae and bases of femora pale flesh, the femora shading apically into pale brown, black at the extreme apex; tibiae and tarsi pale, joints dark.

Wings more or less slightly tinged beyond the arculus or nodus; in one case with milky reflections; stigma very dark brown, almost black.

Described from 5 males, 1 female, Wismar, British Guiana, January 30 and 31, 1912; 2 males, Tumatumari, British Guiana, February 9 and 11, 1912; and 3 males, Potaro Landing, British Guiana, February 10, 1912. Type, a male and allotype, a female from Wismar, in my collection. The name refers to the shape of the terminal abdominal plate of the male.

Paratype.—Cat. No. 19215, U.S.N.M. A male from Wismar, British Guiana, January 31, 1912.

Between Wismar and Christianburg is a small stream flowing into the Demerara River and crossed by the footpath between the two towns. In the afternoon the backward flow of the river due to tides makes this stream almost unwadable near its mouth. We were attracted to this muddy, log-choked creek by the beautiful *Diastatops dimidiata*, which we found nowhere else. The banks of the creek are generally covered with impenetrable brush and the exposed margins are slippery and treacherous, due to the rise and fall of water over them. At places logs are piled so indiscriminately in the creek that progress is slow and difficult; and at places the overhanging bushes

completely shade the stream. It was among these bushes that *E. lamina* and *E. fuscaenea* moved with drifting flight from near the water's surface to rest in the dense vegetation.

When this study was first begun, *lamina* and *incusa* were confused as one species. A male of one of these (I believe certainly *lamina*) and a male of *fuscaenea* were sent to Monsieur Severin for comparison with Selys's material. At the same time a male of *P. aurantiaca* was included, and this is discussed under that species. In my letter with the material to Monsieur Severin I asked him particularly to compare the South American specimens with *humeralis*, *tenuis*, and *capilliformis*. Through Monsieur Severin's kind offices this material was studied by both Grünberg and Ris. Doctor Grünberg thought the 2 specimens I sent were the same species, very near to *capilliformis* but differing in the appendages, and certainly different from both *humeralis* and *tenuis*. When Doctor Ris studied the specimens the end of the abdomen of one (*lamina*) had been lost. Of *fuscaenea* he says: "The appendages are very different from those of *capilliformis* type." Since Doctor Grünberg failed to separate *lamina* and *fuscaenea* by the appendages (though they are really different), it is fair to infer that the appendages of *capilliformis* are clearly different from both *lamina* and *fuscaenea*. Of *tenuis* in the Selys collection Doctor Ris says, "It is a very miserable teneral male specimen resembling *lamina* and *fuscaenea* in shape and dimensions. I can not without a microscope be sure of the appendages in their bad condition." Of *P. humeralis*, "The female looks quite different, is a good deal larger and can not possibly be the female of *lamina* or *fuscaenea*." In a later communication he says, "Regarding your *Protoneuras*, seen by me at Bruxelles, I think you may quite safely describe them as new."

EPIPLEONEURA INCUSA, new species.

Length of abdomen, male 28.5–30 mm.; hind wing, male 17–18.

Head.—Male. Black above with green reflections; labium and a narrow lower border on labrum pale flesh; anteclypeus and genae pale green.

Prothorax.—Male. Dark shining green or black above and on sides; pale flesh below; hind lobe low, convex.

Thorax.—Male. Above dark shining green, covering the mesepisternum and mesepimeron, somewhat duller on the latter, and with a narrow brown humeral line; metepisternum brown above the stigma, darker on the sutures and above, the latter with some green reflections; metepimeron brown above opposite the green area of the metepisternum; below these colored areas and beneath, pale flesh.

Abdomen.—Male. Above black, the basal segments with green reflections; obscure narrow brown basal rings on 4–7; apical articulations on 7, and to a lesser extent on 8, dull yellowish brown; sides black, brown on the extreme lower edge and shading into the dull

yellowish brown of the underparts. Appendages black or very dark brown. The apical one-third or one-fourth of the dorsum of 9 may be pale in life; there is a very slight indication of this in dried material.

Legs.—Male. Coxae and extreme bases of femora pale flesh, rest of femora brown, paler basally and growing darker apically, the extreme apex black; tibiae and tarsi pale, dark at the joints.

Wings.—Male. Clear, with slight, more or less faint brownish tinge beyond the arculus; stigma brown.

Described from 3 males, one very teneral, Tumatumari, British Guiana, February 5 and 9, 1912; and 1 male, Rockstone, British Guiana, February 1, 1912; the last, the type in my collection.

The specific name refers to the shape of the terminal abdominal plate of the male.

Paratype.—Cat. No. 19216, U.S.N.M. A male from Tumatumari, British Guiana, February 9, 1912.

Frequents small wooded streams. For notes on identity, see under *E. lamina*.

EIPLEONEURA FUSCAENEA, new species.

Length of abdomen, male 26.5–27 mm.; hind wing, male 17–17.5.

Head.—Male. Black; labium pale flesh; lower third of labrum yellow; anteclypeus, excepting a round median black spot, and frons below in front, dull pale yellow, continuous with the pale greenish genae.

Prothorax.—Male. Dorsum dark shining green, less clear than in the two preceding species; sides dark ruddy or bronzy brown; beneath light brown.

Thorax.—Male. Above dark shining green, less clear than in the two preceding species, covering the mesepisternum; below and behind the humeral suture to the latero-ventral metathoracic carina dark ruddy or bronzy brown with greenish reflections, especially on the mesepimeron and adjoining the wing bases; beneath very light brown, pale flesh posteriorly.

Abdomen.—Male. Black; very faint and obscure paler basal rings on 4–7; sides below but slightly paler than the dorsum; under parts dark brown. Appendages black.

Legs.—Male. Coxae brown; femora at extreme base pale flesh, otherwise black; tibiae narrowly black beneath from the base to near the apex, otherwise pale flesh except at the extreme apex, which is dark; tarsi pale with dark joints.

Wings clear, sometimes very slightly tinged with brownish apically and anteriorly; stigma black.

Described from 4 males, Wismar, British Guiana, January 30 and 31, 1912, in my collection. The specific name refers to the thoracic color. For further notes and identity, see under *E. lamina*.

Paratype.—Cat. No. 19217, U.S.N.M. A male from Wismar, British Guiana, January 30, 1912.

PSAIRONEURA REMISSA Calvert.

The following captures may be recorded:

Guatemala: Puerto Barrios, June 23, 1909, in woods along a small stream, only a few feet above sea level, 2 males. Los Amates, June 21, 1909, along a small wet-weather stream in woods, 1 male.

Costa Rica: All collected by Doctor and Mrs. Calvert, Florida Road, west of Guapiles, by side of shady brook in forest, June 3, 1909, 1 male. Reventazon Valley, near Juan Vinas, small streams, elevation 2,500 feet, June 28, 1909, and April 28 and May 31, 1910, 5 males, 1 female. Upper Reservoir, Banana Riu, forest, November 9, 1909, 2 males.

In the Costa Rica material the metepisternum and metepimeron are largely pale; in the Guatemala material both are largely dark, in the extreme the metepisternum entirely black, except a small area about the metastigma, and the metepimeron, except the area immediately adjoining the latero-ventral carina.

Doctor Calvert has kindly given me the following notes on his Costa Rica material:

Male, eyes bright red in front, yellowish (pale yellow) below, dark brown with some blue reflections above; dorsum of head, thorax, and anterior abdominal segments, dark metallic green; nasus with blue reflection and a blue spot on each side of ocellar triangle; frons anteriorly, most of clypeus and lips, metapleuron, pectus and inferior lateral margins of 1-8, pale brownish yellow; 9 or 9 and 10 pruinose white, and this area is the only part of the insect that was visible as it "floated" in the gloom of the forest over clay mud about a small water hole. At Juan Vinas along a deeply shaded rivulet, near to and west of Rio Naranjo, June 28, 1909, 2 males were taken moving over the water's surface, an inch or two above it, hardly visible except for the conspicuous paler blue ninth abdominal segment (faded after death). Female, eyes greenish-yellow below, dark brown above; much less bluish reflections on nasus, but blue spot present on each side of ocellar triangle; mesepimeron pale brown, metapleuron yellow; hind dorsal margin of 6-8 narrowly pale blue.

PSAIRONEURA CERASINA, new species.

Length of abdomen, male, 26 mm.; hind wing, 16.5.

Head.—Male. Beneath and rear of eyes pale flesh; in front, including the extreme lower edge of the frons, very pale obscure yellow; labium with a large geminate black spot across its base, and a stripe of black of equal width on the clypeus, these two black areas isolated; above black with metallic green reflections; antennae brown.

Prothorax.—Male. Flesh color with suggestions of red, especially dorsally; the posterior lobe low, convex, and largely occupied medially by an extension of the median dark color of the mesepisterna.

Thorax.—Male. Dorsum for its entire length with a uniform stripe of metallic blue which covers, on either side, about one-half of the mesepisternum; on either side of this middorsal stripe, orange or

reddish flesh color without dark markings, and passing insensibly into pale flesh on the metasternum (exactly resembling a *Metaleptobasis*).

Abdomen.—Male. Segment 1 continuing the pale color of the thorax, with a shining blue-black apical ring which is widest in the middorsal line; 2 similar, with the color of the apical ring covering all the middorsum but the extreme base; 3–6 black, each with a narrow pale yellow basal ring which is narrowed or interrupted in the middorsal line; posterior to the middle of each of these segments is a scarcely discernible brown area, in length about equal to the black area posterior to it; 7 at its base is colored like the preceding segments but about its middle it begins to change to red, and at its apex it is entirely this color; 8–10 red. Appendages dark reddish brown, almost black externally, pale internally. Inferior appendages barely discernible in lateral and dorsal views; in posterior view they are seen as flattened, equilateral triangular bodies with each side slightly concave, the posterior surface not bearing any spine or tubercle which makes the so-called “inferior appendage,” as seen in profile or dorsal view, in the larger number of species. The real significance of “inferior appendages present” and “inferior appendages absent” in this and related species is that in one case the posterior surface of the inferior appendage bears or is projected into some sort of a posterior tubercle or prominence which is wanting in the other case.

Legs.—Male. Pale yellowish; femora each with a subapical pale brown area, and a similar area on each tibia at about one-third its length.

Wings beyond the nodus slightly milky, stigma black.

Described from 1 male, Wismar, British Guiana, January 30, 1912, in my collection. Just back of Wismar and north of the railroad track is a bit of brushy swampy woods in which numerous small streams lose themselves. The specimen was taken here among the rank vegetation. In life it is a delicate and beautiful insect, the translucent red parts of the thorax and especially the abdomen suggesting the specific name.

EPIPOTONEURA NEHALENNIA, new species.

Length of abdomen, male 25 mm., female 22; hind wing, male 15 mm., female 15.

Head.—Male. Black, above with green reflections; labium pale flesh; lower half of labrum dull pale yellow; anteclypeus and frons below in front light yellow, continuous on either side with the yellow genae; a very small triangular green spot, surrounded with black, in front of each antenna and on the frons in front.

Female similar to male; base of labrum brown instead of black, and the green spots in front of the antenna larger and with a narrower border of black.

Prothorax.—Male and female. Dark shining green above, pale flesh below; hind lobe low, convex.

Thorax.—Male and female. Above dark shining green, entirely covering the mesepisternum and mesepimeron and the upper end of the metepisternum; below this and beneath pale flesh.

Abdomen.—Male. Above black, 4–6 with very narrow pale basal rings; apical articulations on 7–9 narrowly yellowish; sides below shading out to pale dull yellow of the under color; lateral pale area widest on 8–9; appendages very dark brown, extreme apex black.

Female similar to male but the dorsum more metallic and on the basal segments especially with greenish reflections; dorsal color narrower, so the sides are more extensively pale; very narrow basal rings on 2–7; pale apical articulations on 7–8 only. Genital valves not reaching the apex of 10, the short palpi, with a knobbed or swollen base, slightly exceeding 10; appendages conical, slightly shorter than 10.

Legs.—Male and female. Pale flesh, extreme apex of femora, tibiae and tarsi black.

Wings clear with milky reflections in one female; stigma brown, darker in the male.

Described from a male and a female, pairing, from Potaro Landing, British Guiana, February 10, 1912, in my collection; and 1 female, Tumatumari, British Guiana, February 8, 1912. The male from Potaro Landing is the type. The specific name is an allusion to the superficial resemblance to species of the genus *Nehalennia*.

Paratype.—Cat. No. 19218, U.S.N.M. A female specimen from Tumatumari, British Guiana, February 8, 1912.

In the tabulation of characters the following material has been studied, each wing meaning one front and hind wing:

Protoneura calverti, 16 male wings, 9 female wings; *P. corculum*, 8 male wings, 2 female wings; *P. amatoria*, 23 male wings, 2 female wings; *P. aurantiaca*, 10 male wings, 2 female wings; *P. cara*, 6 male wings; *P. cupida*, 4 male wings; *P. capillaris*, 1 male wing and drawing by Doctor Calvert of basal parts of another; *Epipleoneura fuscaenea*, 8 male wings; *E. incusa*, 8 male wings; *E. lamina*, 20 male wings, 2 female wings; *Psaironeura remissa*, 23 male wings, 2 female wings; *P. cerasina*, 2 male wings; *Epipotoneura nehalennia*, 4 male wings, 2 female wings. Of this material one hind wing of *corculum* and one front wing of *cara* were damaged and certain parts lost. In tabulating characters the sexes were kept separate, but, as sexual differences were not apparent, the data were combined in the following table.

[illegible]

Venational characters of *Protoneura* (*sensu latiore*)—Continued.

Characters.	Wings.	<i>Proto- neura calverti</i> .	<i>P. corcu- lum</i> .	<i>P. ama- toria</i> .	<i>P. auran- tiaca</i> .	<i>P. cara</i> .	<i>P. cupida</i> .	<i>P. capil- laris</i> .	<i>Epipleo- neura fuscaenea</i> .	<i>E. incusa</i> .	<i>E. lamina</i> .	<i>Psairo- neura remissa</i> .	<i>P. cera- sina</i> .	<i>Epipoto- neura nehale- na</i> .
42. Second antenodal proximal to areolus from more than one-half to about three-fourths length of areolus.	Front. Hind...	.....	.....	.....	2 = 16% 8 = 66%	.....	2 = 50%	.....	1 = 12% 1 = 12%	1 = 12% 4 = 50%	.....	.....	.....	.....
43. Second antenodal proximal to areolus slightly less than length of areolus.	Front. Hind...	5 = 20% 4 = 16%	4 = 40% 2 = 20%	8 = 32% 5 = 20%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
44. Second antenodal proximal to areolus about length of areolus.	Front. Hind...	7 = 28% 6 = 24%	6 = 60% 8 = 80%	17 = 68% 20 = 80%	.....	.....	4 = 100%	.....	.....	.....	.....	.....	.....	.....
45. Second antenodal proximal to areolus more than length of areolus.	Front. Hind...	10 = 40% 15 = 60%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
46. Cubito-anal cross vein about level of first antenodal, or distal one-eighth or less of the second antenodal costal space.	Front. Hind...	.....	.....	.....	.....	6 = 100% 6 = 100%	.....	.....	.....	.....	.....	.....	.....	.....
47. Cubito-anal cross vein distal to first antenodal one-sixth to one-fourth second antenodal costal space.	Front. Hind...	4 = 16% 20 = 80%	6 = 60% 10 = 100%	2 = 8% 2 = 8%	4 = 33% 5 = 42%	.....	2 = 50% 4 = 100%	1 = 100% 1 = 100%	.....	2 = 25% 1 = 4%	.....	.....	.....	.....
48. Cubito-anal cross vein distal to first antenodal about one-third second antenodal costal space.	Front. Hind...	16 = 64% 5 = 20%	4 = 40%	.....	8 = 66% 7 = 58%	.....	2 = 50%	.....	2 = 25% 2 = 25%	2 = 25% 6 = 75%	4 = 18% 15 = 67%	.....	.....	6 = 100% 6 = 100%
49. Cubito-anal cross vein distal to first antenodal less than one-half second antenodal costal space.	Front. Hind...	5 = 20%	.....	18 = 72% 23 = 92%	.....	.....	.....	.....	4 = 50% 3 = 37%	.....	18 = 81% 6 = 27%	25 = 100% 25 = 100%	.....	.....
50. Cubito-anal cross vein distal to first antenodal about one-half second antenodal costal space.	Front. Hind...	.....	.....	5 = 20%	.....	.....	.....	.....	2 = 25% 2 = 25%	6 = 75%	.....	.....	.....	.....
51. Cubito-anal cross vein distal to first antenodal slightly more than one-half second antenodal costal space.	Front. Hind...	.....	.....	.....	.....	.....	.....	.....	2 = 25% 1 = 12%	.....	.....	2 = 100% 2 = 100%	.....	.....
52. R ₂ and M ₃ joined at first descending cross vein.	Front. Hind...	4 = 16% 25 = 100%	10 = 100% 10 = 100%	25 = 100% 25 = 100%	1 = 8% 12 = 100%	6 = 100% 6 = 100%	4 = 100% 4 = 100%	1 = 100% 1 = 100%	8 = 100% 8 = 100%	8 = 100% 8 = 100%	22 = 100% 22 = 100%	2 = 8% 2 = 8%	2 = 100% 2 = 100%	3 = 50% 5 = 83%
53. R ₂ and M ₃ distinct at first descending cross vein.	Front. Hind...	21 = 84%	10 = 100%	25 = 100%	11 = 92%	6 = 100%	4 = 100%	1 = 100%	8 = 100%	8 = 100%	22 = 100%	23 = 92%	2 = 100%	1 = 16%

54.	Upper limb of arculus less than one-half lower limb in length.	Front... Hind...	8= 32% 24= 96%	4= 33% 4= 33%	2= 50%	4= 50% 3= 37%			
55.	Upper limb of arculus about one-half lower limb in length.	Front... Hind...	12= 48% 10= 100% 10= 100%	6= 50% 4= 33% 2= 33%	2= 50% 2= 33%	4= 50% 5= 62%	3= 14% 7= 31%	25= 100% 25= 100%	2= 100% 2= 100%
56.	Upper limb of arculus more than one-half lower limb in length.	Front... Hind...	5= 20% 1= 4%			1= 100%			
57.	Upper limb of arculus about two-thirds to three-fourths lower limb in length.	Front... Hind...	12= 48% 12= 48%	2= 16% 4= 33%	4= 66% 4= 66%	1= 100% 1= 100%	6= 75% 6= 75%	19= 85% 15= 67%	6= 100% 6= 100%
58.	Stigma slightly longer than wide.	Front... Hind...							
59.	Stigma one and one-fourth to one and three-fourths times as long as wide.	Front... Hind...	10= 100% 10= 100%	6= 100% 6= 100%	4= 100% 4= 100%	1= 100% 1= 100%	8= 100% 8= 100%	25= 100% 25= 100%	2= 100% 2= 100%
60.	Stigma about twice as long as wide.	Front... Hind...	25= 100% 25= 100%	12= 100% 12= 100%					
61.	Stigma two and one-half to three times as long as wide.	Front... Hind...							
62.	Stigma covering much less than one cell.	Front... Hind...							
63.	Stigma covering slightly less than one cell.	Front... Hind...	16= 64% 13= 52% 9= 36% 12= 48%	3= 30% 4= 44% 7= 70% 5= 55%	8= 32% 5= 20% 16= 64% 18= 72%	4= 66% 2= 33% 2= 33% 4= 66%	3= 37% 2= 50% 5= 63% 6= 75%	1= 4% 7= 31% 18= 81% 13= 58% 3= 14% 1= 4%	6= 100% 6= 100% 6= 100% 6= 100% 2= 100% 2= 100%
64.	Stigma covering one cell.	Front... Hind...							
65.	Stigma covering slightly more than one cell.	Front... Hind...	2= 8%						

PROPORTIONATE LENGTHS OF ABDOMINAL SEGMENTS OF SPECIES OF PROTONEURA (SENSU LATIORE).

[illegible]

See page 636 for footnotes to tabulation of venation.

FOOTNOTES TO TABULATION OF VENATION.

a In those cases where Cu_1 terminates against the descending cross vein and not at its posterior termination, the cross vein is more or less angled at the point of contact and the posterior termination of the cross vein is deflected apically. In extreme cases of this which I have noticed in *calberti* and other species Cu_1 appears at first glance to be produced beyond the descending cross vein, but in no such cases does the cross vein actually cross Cu_1 to reach the wing margin basally to the termination of Cu_1 , and this apparent extension of Cu_1 is really the apically deflected posterior end of the descending cross vein.

b The position of termination of M_2 , or any unbroken vein, is much more accurately treated in tabulations than the same character for broken veins such as M_4 which near its termination may disappear in the posterior wing margin proximal to its real termination (see hind wings of *calberti* and *cara*, pl. 41, figs. 1 and 5).

c The first antenodal costal space is the space between wing base and first antenodal. The second antenodal costal space is the space between the antenodals. The third antenodal costal space is the space between the second antenodal and the nodus.

d In 1 female both hind wings have R_4 arising very slightly proximal to the subnodus. The same wings have R_4 and M_3 joined at the first descending cross vein.

e In 1 hind wing of a male from Morales the first antenodal costal space is very long, due to the distal displacement of the first antenodal.

f Distal about one-fourth the second antenodal costal space in all 4 wings of a single individual.

g In one wing there is a cross vein at right angles to the wing in the area beyond the descending cross vein and bounded by Cu_1 and the posterior wing margin.

h In one left wing Cu_1 extends far beyond the cross vein, but the latter is *not* continued to the wing margin.

i In 2 wings Cu_1 is produced as far apically as the next cross vein beyond the cross vein descending from the subnodus.

k In one left wing the first antenodal is displaced distally, making the second antenodal costal space very short and lengthening the first space. In the same wing the cubitoanal cross vein is displaced distally. In another individual a left wing has an added antenodal in the first series between the 2 normal antenodals.

l An individual in which M_2 was displaced apically in all 4 wings.

m In 5 front wings and 11 hind wings Cu_1 ends against the descending cross vein instead of at its posterior termination and in each of these cases the posterior termination of the cross vein is slightly deflected apically.

n In one wing there is a basally directed spur from M_{1a} extending about one-third across the cell basal to M_{1a} at its origin.

o In one wing covering only about two-thirds of a cell.

p In 2 wings covering only about one-half a cell, due to irregularity in cells posterior to the stigma rather than to any variation in the stigma itself.

r In one wing due to the same causes discussed under footnote *p*.

EXPLANATION OF PLATES.

PLATE 38.

All figures with same magnification. All profile views are of the left side. Male appendages are all apically black, and the sparse short hairs, which are present, are omitted in the drawings. Figs. 1-18, males; figs. 19-21, female.

Figs. 1-4. *Metaleptobasis bovilla*; 1 and 2, lateral and dorsal views of male appendages; 3 and 4, dorsal and lateral views of mesothoracic horns.

Figs. 5-8. *M. brysonima*; same as *bovilla*.

Figs. 9-12. *M. mauritia*; same as *bovilla*.

Figs. 13-18. *M. manicaria*; 15, 16, and 17 are dorsal views of mesothoracic horns to show individual variation; in profile in this species the mesothoracic horns are wider subapically, as shown in fig. 18.

Figs. 19-21. *M. (?)* sp. Rockstone, British Guiana; 19, lateral view, 20, anterior view, and 21 dorsal view of prothoracic horns.

PLATE 39.

Magnification greater in fig. 3 than in figs. 1 and 2.

Figs. 1 and 2. Wings of *Metaleptobasis manicaria*, 2 male specimens from Cumuto, Trinidad, March 10, 1912.

Fig. 3. Wings of *Leptobasis vacillans*, male, Los Amates, Guatemala, January 18, 1905.

In figs. 1 and 2, compare position of arculus with reference to second antenodal, and origin of M_{1a} and M_2 in hind wings. The differences in the antenodal-arcus relations of the 2 specimens result directly from differences in the distance from wing base to nodus, this distance being greater in fig. 1 than in fig. 2.

Comparing figs. 1 and 2 with fig. 3, the origin of M_2 with reference to the postnodals is a striking character and the only venational character employed at present in separating the genera. Another and more significant character is: In *Metaleptobasis* A and Cu_2 are in the same line, while in *Leptobasis* A and Cu_2 are not in the same line, bracing having taken place at the end of MA.

PLATE 40.

Wing photographs of *Palaemnema paulina* males, made by Miss Mary B. Lyon, Cornell University.

Fig. 1. El Fiscal, Guatemala, June 5, 1909; front and hind wings, showing the unusual 5-sided subquadrangle.

Fig. 2. El Fiscal, Guatemala, June 6, 1909; front and hind wings, showing the added antenodal in the front wing.

Fig. 3. El Fiscal, Guatemala, June 6, 1909; 2 hind wings, showing added antenodal in the upper (left) wing.

PLATE 41.

Wing photographs.

Fig. 1. *Protoneura calverti*, male, Potaro Landing, British Guiana, February 10, 1912.

Fig. 2. *Protoneura corculum*, male, Morales, Guatemala, May 21, 1909.

Fig. 3. *Protoneura amatoria*, male, Puerto Barrios, Guatemala, March 6, 1905.

Fig. 4. *Protoneura aurantiaca*, male, Los Amates, Guatemala, June 21, 1909.

Fig. 5. *Protoneura cara*, male, Agua Caliente, Dept. Santa Rosa, Guatemala, June 2, 1909.

PLATE 42.

Wing photographs.

- Fig. 6. *Protoneura capillaris*, male, Cuba, collected by C. L. Wright, Coll. Acad. Nat. Sci., Philadelphia.
Fig. 7. *Epipleoneura fuscaenea*, male, Wismar, British Guiana, January 31, 1912.
Fig. 8. *Epipleoneura incusa*, male, Tumatumari, British Guiana, February 5, 1912.
Fig. 9. *Psaironeura remissa*, male, Los Amates, Guatemala, June 21, 1909.
Fig. 10. *Epipotoneura nehalennia*, female, Tumatumari, British Guiana, February 9, 1912.

PLATE 43.

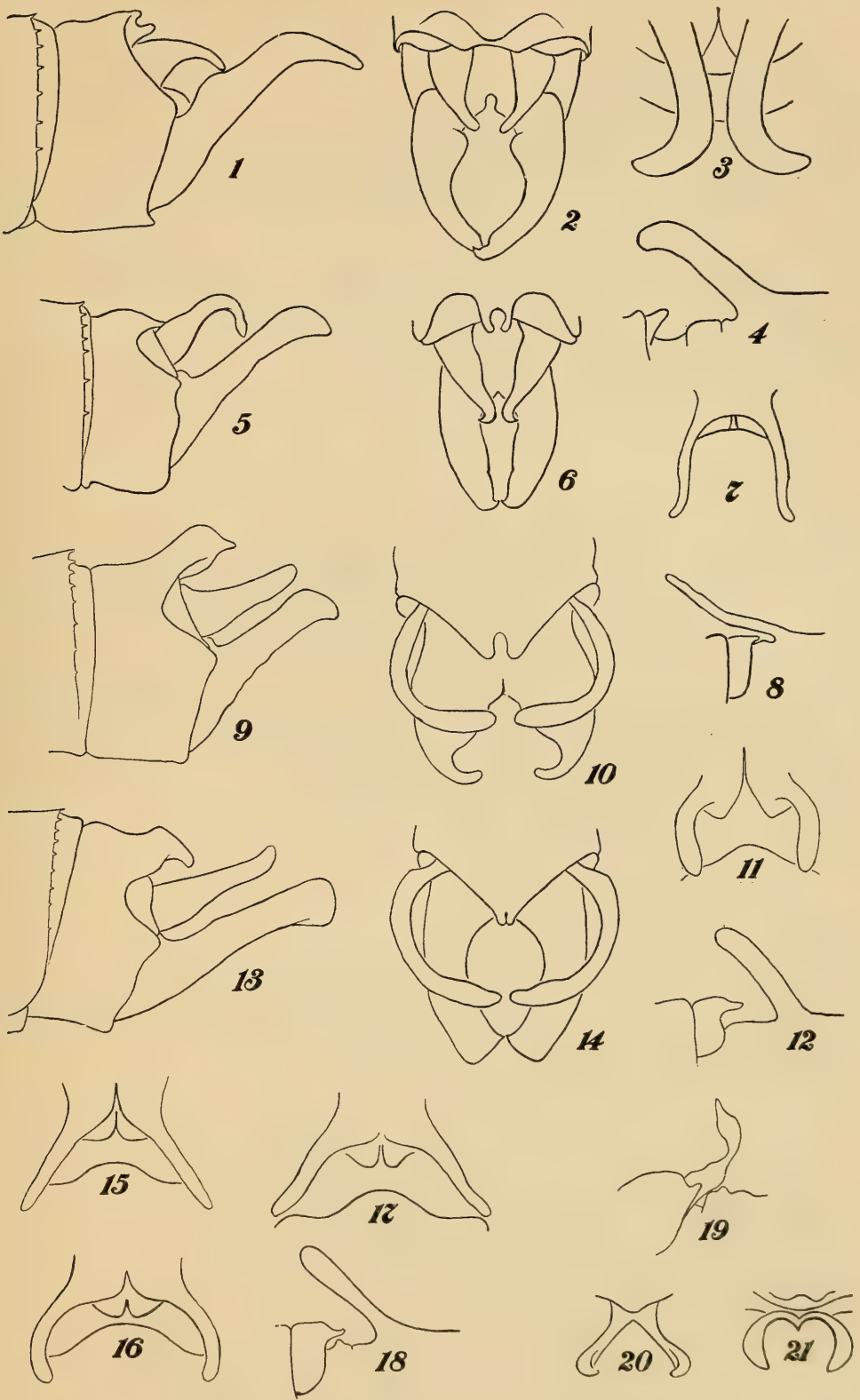
Diagrams to show thoracic color pattern.

- Figs. 11 and 12. *Protoneura calverti*, male and female.
Figs. 13 and 14. *Protoneura corculum*, male and female.
Figs. 15 and 16. *Protoneura amatoria*, male and female.
Fig. 17. *Protoneura aurantiaca*, male.
Fig. 18. *Protoneura cupida*, male.
Fig. 19. *Protoneura cara*, male.
Fig. 20. *Epipleoneura incusa*, male.
Fig. 21. *Psaironeura cerasina*, male.
Fig. 22. *Epipotoneura nehalennia*, male.

PLATE 44.

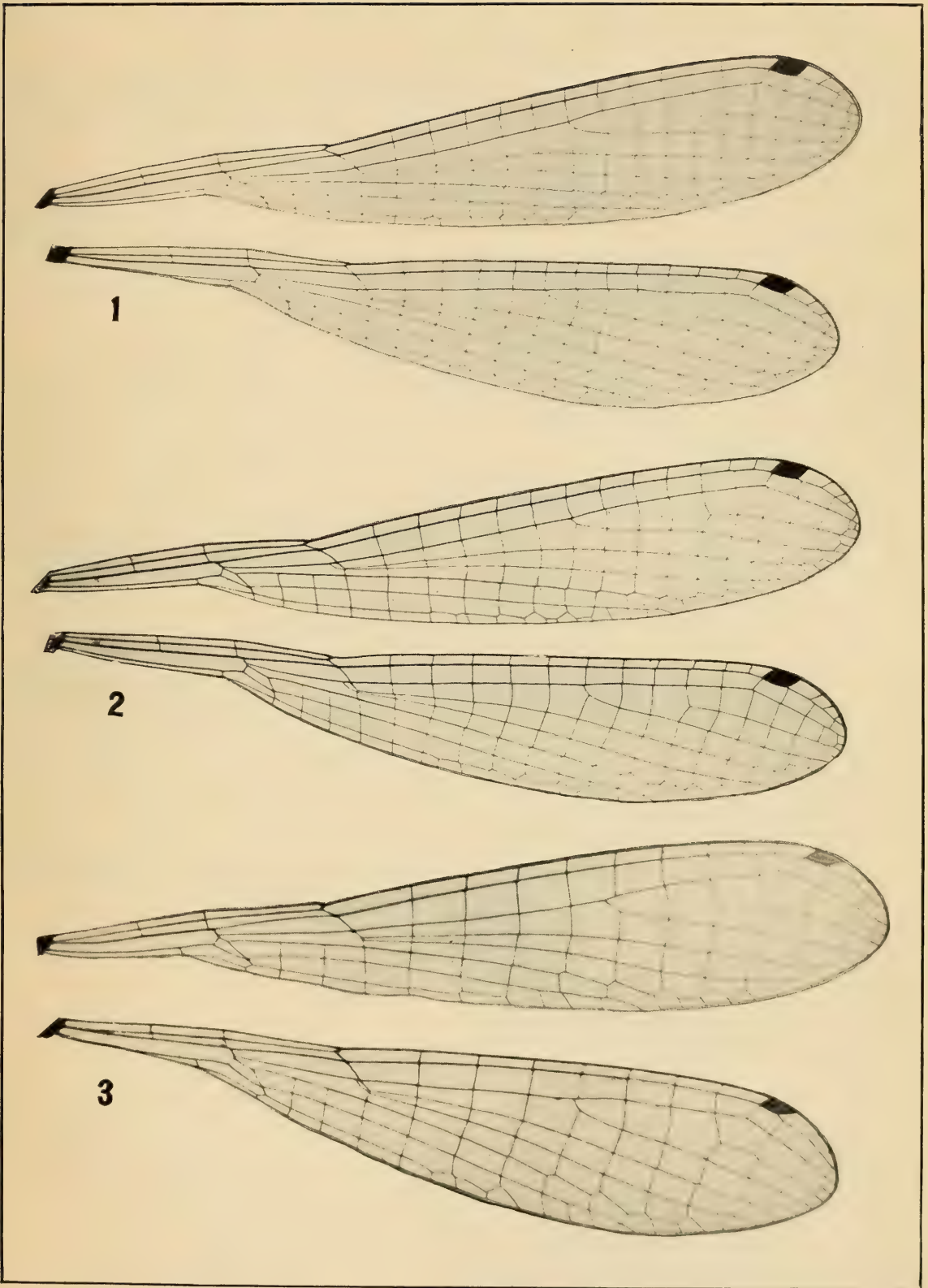
Profile and dorsal views of male appendages, all drawn to same scale.

- Figs. 23 and 24. *Protoneura calverti*, type, Tumatumari, British Guiana, February 8, 1912.
Figs. 25 and 26. *Epipleoneura lamina*, type, Wismar, British Guiana, January 30, 1912.
Figs. 27 and 28. *Epipleoneura incusa*, type, Rockstone, British Guiana, February 1, 1912.
Figs. 29 and 30. *Epipleoneura fuscaenea*, type, Wismar, British Guiana, January 31, 1912.
Figs. 31 and 32. *Psaironeura cerasina*, type, Wismar, British Guiana, January 30, 1912.
Figs. 33 and 34. *Epipotoneura nehalennia*, type, Potaro Landing, British Guiana, February 10, 1912.



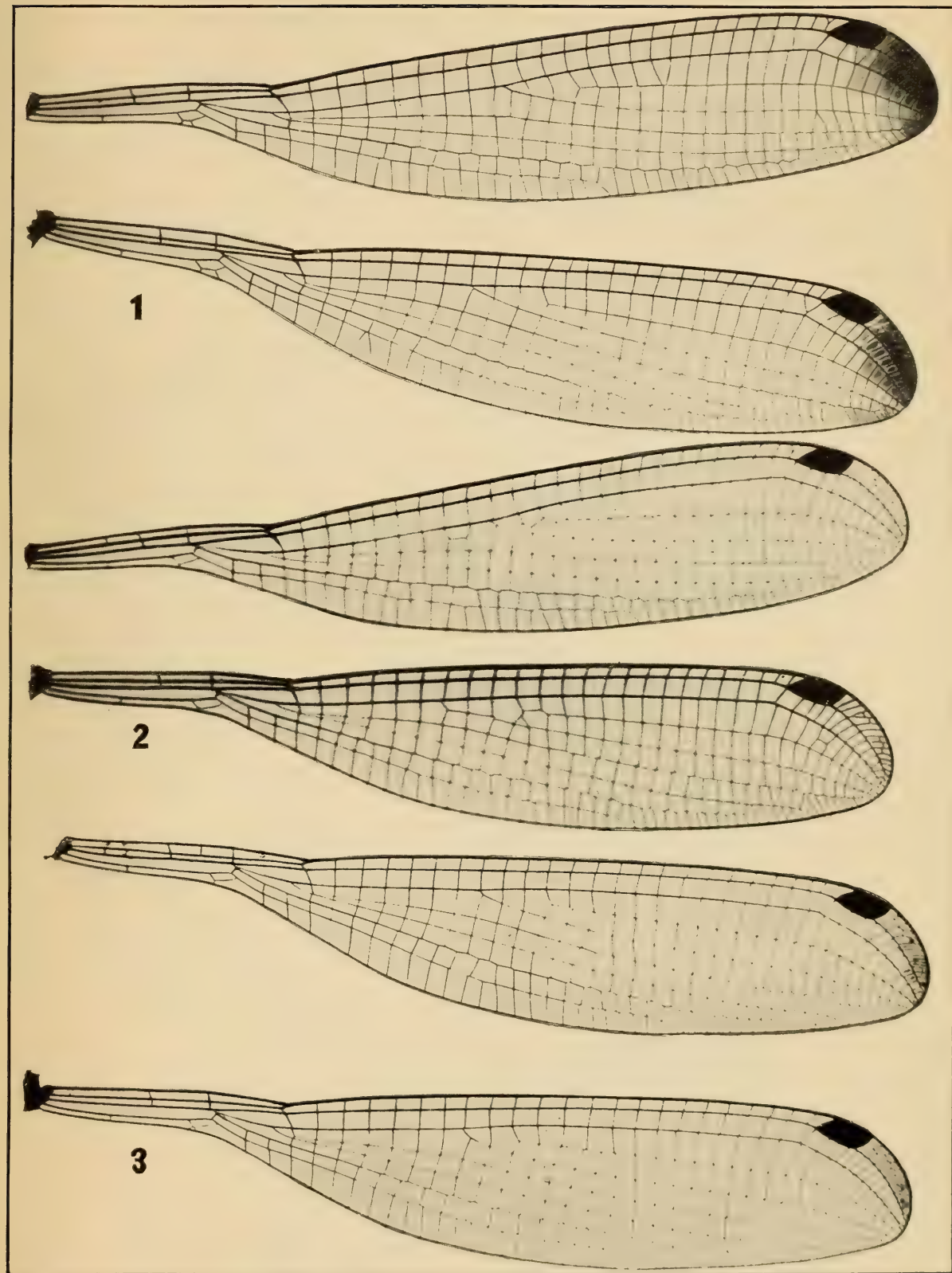
ANATOMICAL DETAILS OF METALEPTOBASIS.

FOR EXPLANATION OF PLATE SEE PAGE 637.



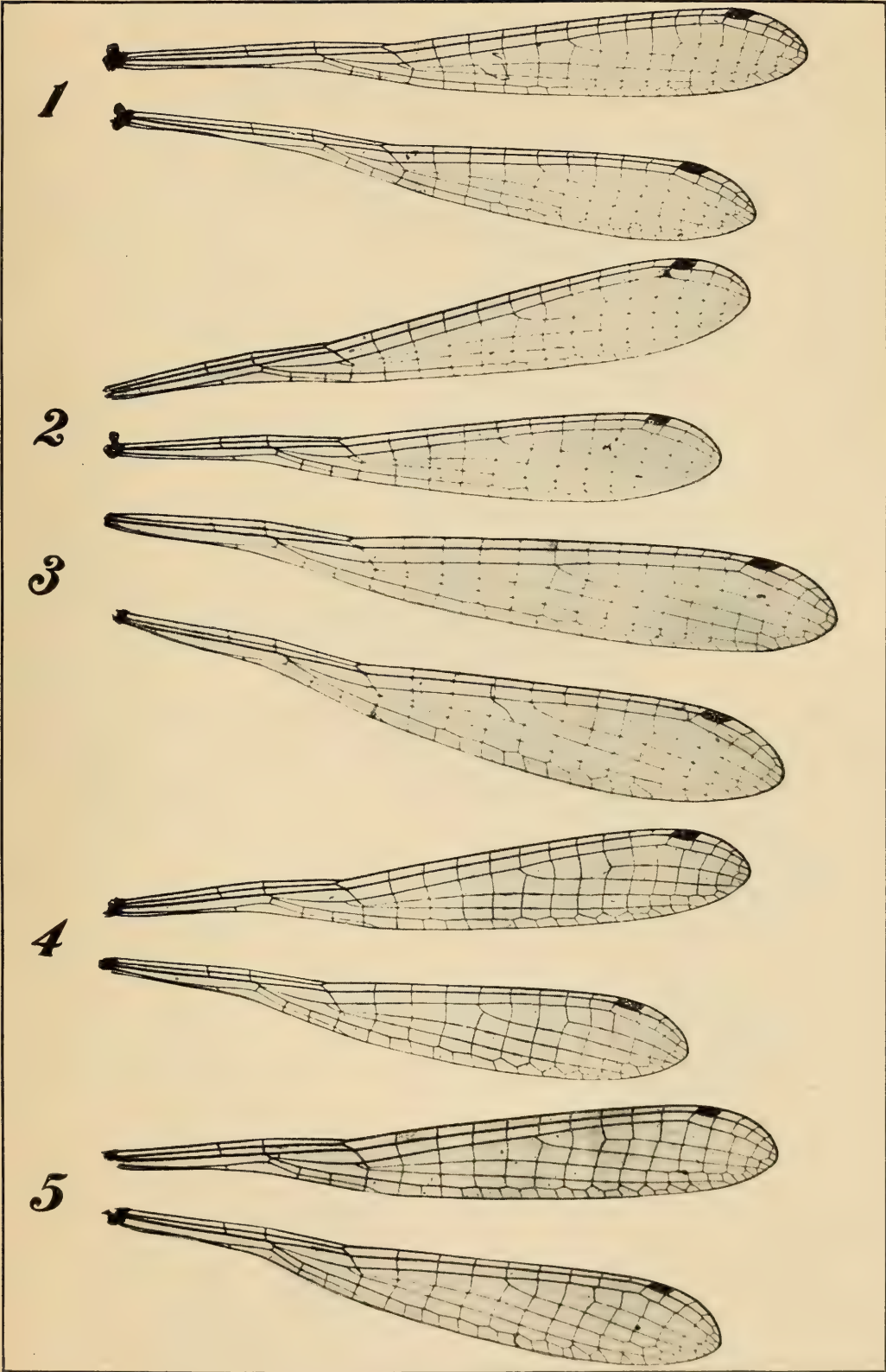
WING PHOTOGRAPHS OF LEPTOBASIS AND METALEPTOBASIS.

FOR EXPLANATION OF PLATE SEE PAGE 637.



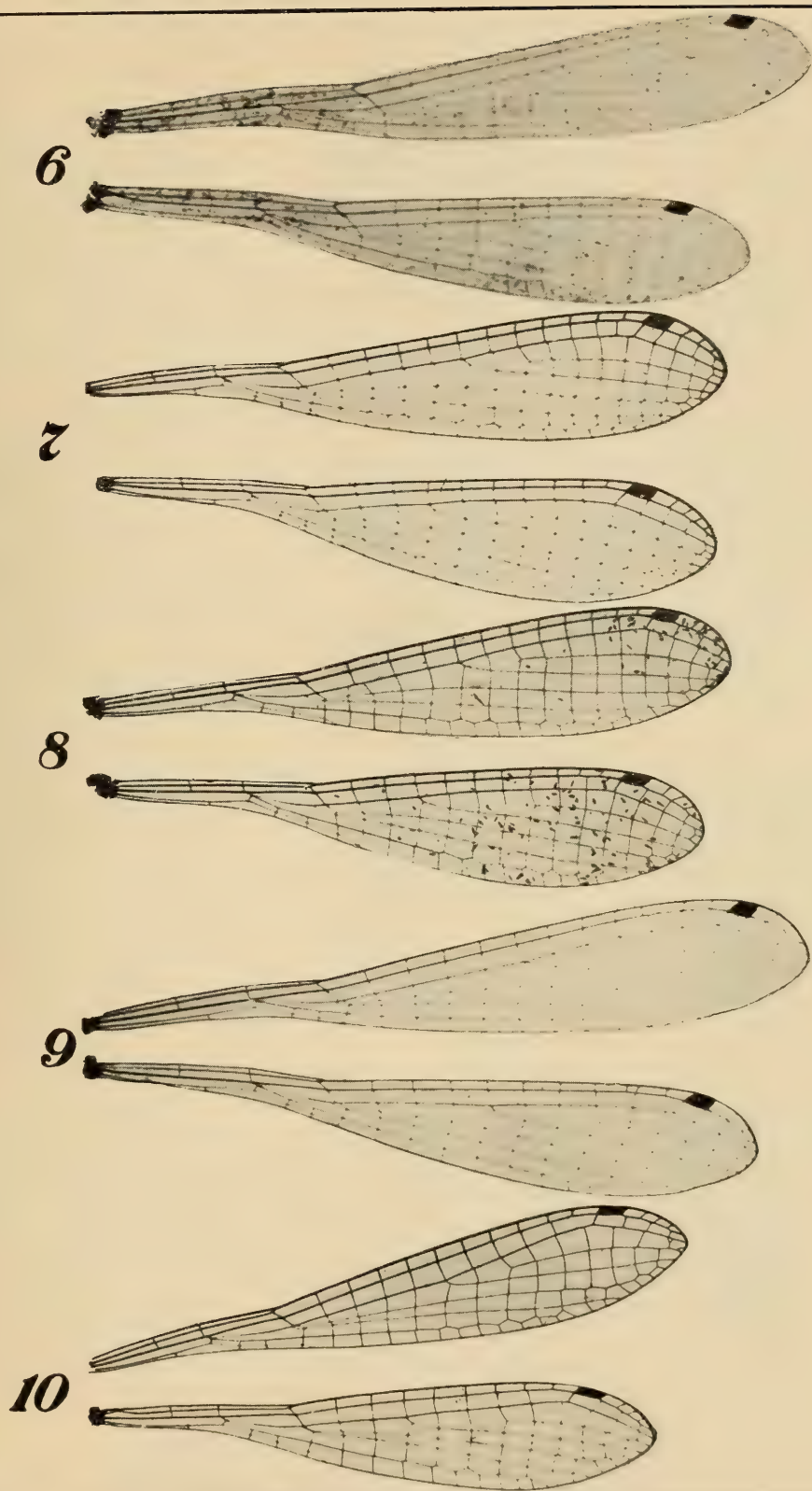
WING PHOTOGRAPHS OF PALAEMNEMA.

FOR EXPLANATION OF PLATE SEE PAGE 637.



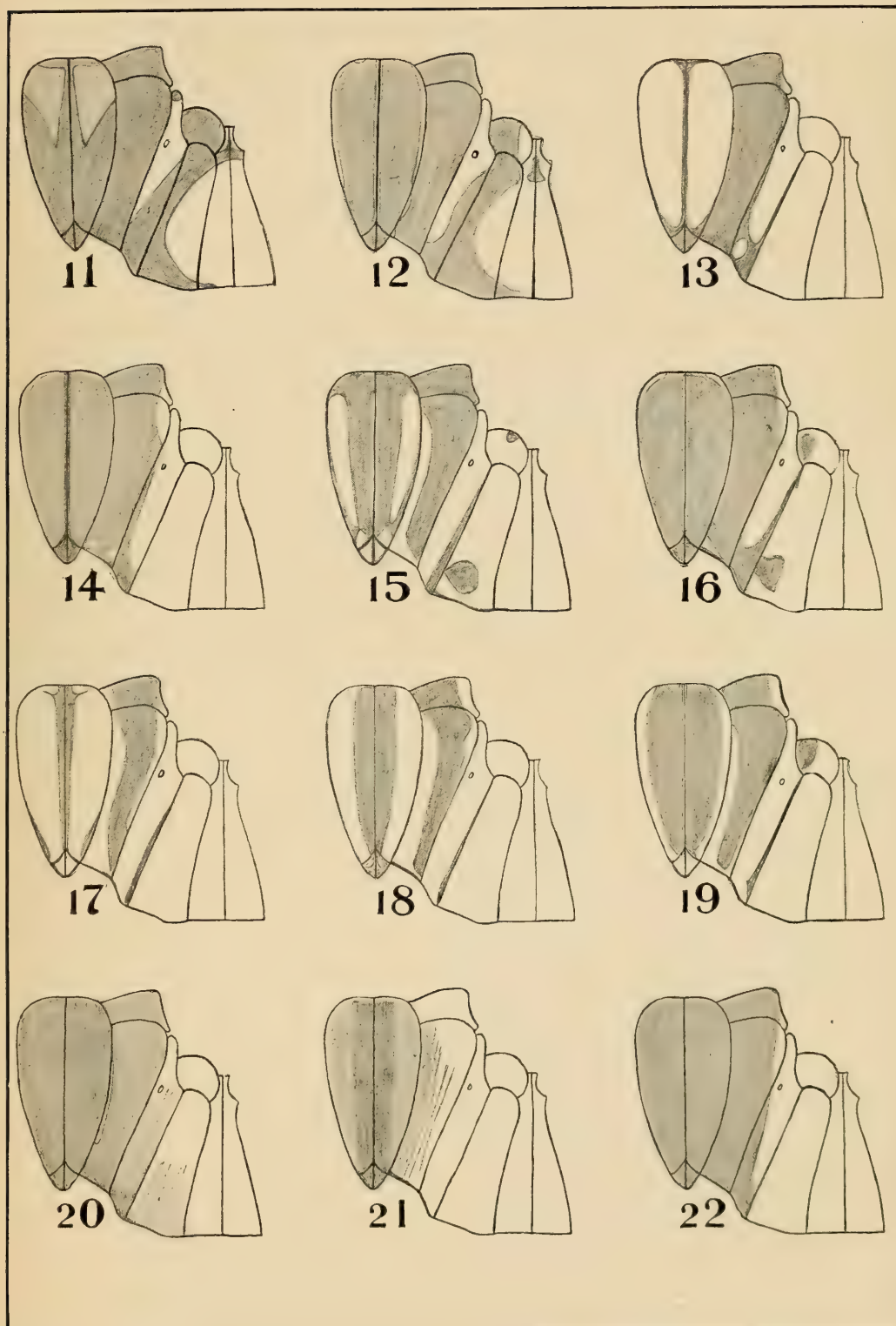
WING PHOTOGRAPHS OF PROTONEURA.

FOR EXPLANATION OF PLATE SEE PAGE 637.



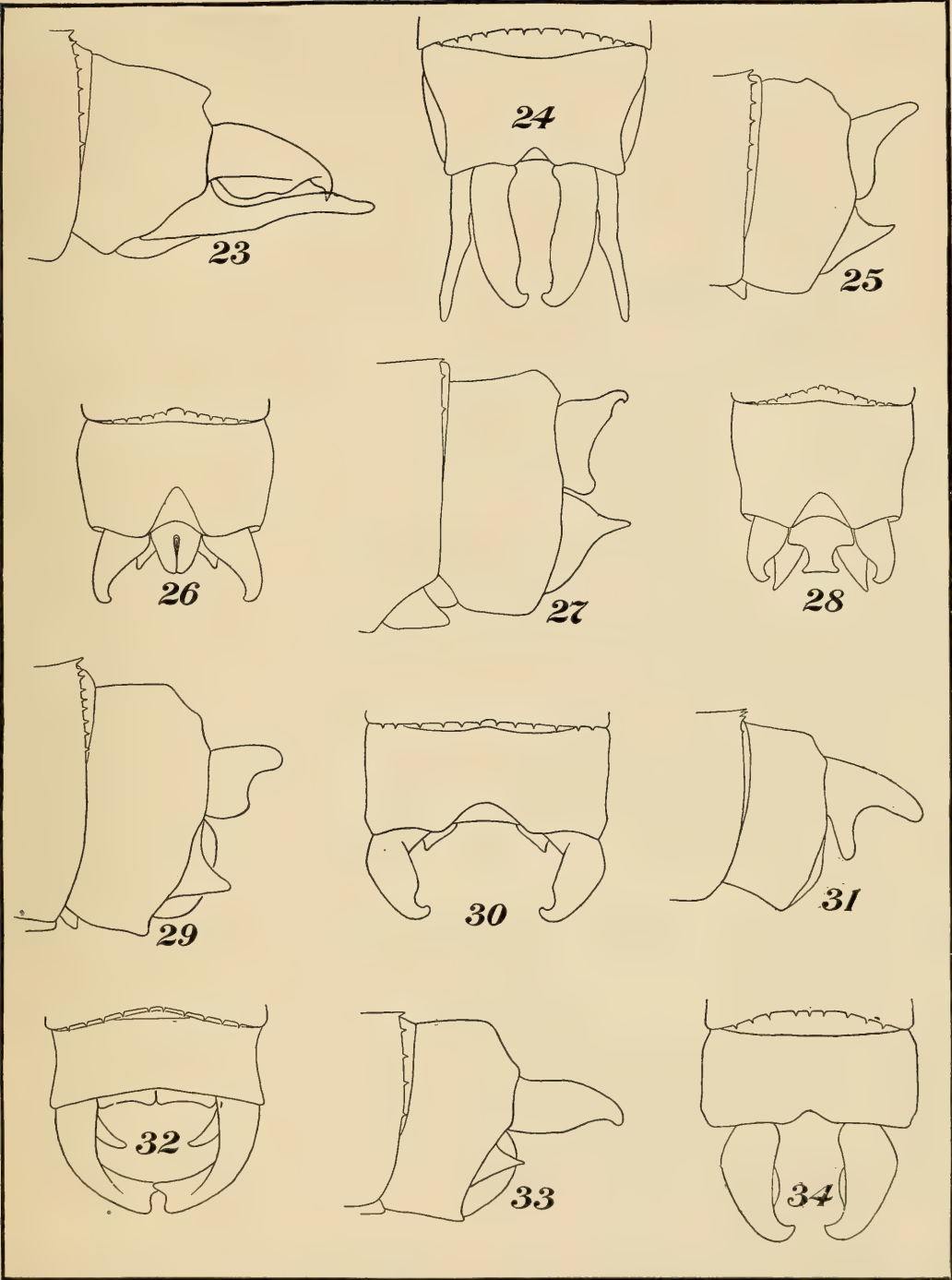
WING PHOTOGRAPHS OF PROTONEURA.

FOR EXPLANATION OF PLATE SEE PAGE 638.



THORACIC COLOR PATTERNS OF PROTONEURA.

FOR EXPLANATION OF PLATE SEE PAGE 638.



MALE APPENDAGES OF PROTONEURA.

FOR EXPLANATION OF PLATE SEE PAGE 638.

A REVIEW OF THE SUBSPECIES OF THE RUDDY KING-FISHER, *ENTOMOTHERA COROMANDA* (LINNAEUS).

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In order satisfactorily to identify some of the East Indian material collected by Dr. W. L. Abbott it has been necessary to work out the relationships of all the subspecies of *Entomothera coromanda* (Linnaeus). Since this has resulted in the necessity of recognizing several additional races, and in changing the diagnoses and distribution of some others, it seems worth while to put these conclusions on record. For this investigation there have been available some 60 specimens, including representatives of all the forms here admitted. For the use of this material the writer is indebted to the authorities of the United States National Museum, the Academy of Natural Sciences of Philadelphia, and the Museum of Comparative Zoölogy in Cambridge, Massachusetts; and also to Mr. J. H. Fleming, of Toronto, Ontario, Canada, whose collection of exotic birds far exceeds that of any private individual in America. Furthermore, Dr. Leonhard Stejneger, head curator of biology in the United States National Museum, has kindly allowed me the use of his manuscript notes on this species.

The names of colors here employed are based on Mr. Robert Ridgway's recently published *Color Standards and Color Nomenclature*.¹ The measurements are all in millimeters, and are taken as explained in a previous publication by the writer.² All the specimens examined are entered in the tables of detailed measurements, and those used in the diagnostic averages are indicated.

The literature of *Entomothera coromanda* is meager, and consists chiefly of scattered notes and mention in faunal or systematic papers. The most important notices of the latter kind are as follows:

SHARPE, R. B.—*Monograph of the Alcedinidae*, vol. 2, 1870, pp. 155–157, pl. 57.

SHARPE, R. B.—*Catalogue of the Birds in the British Museum*, vol. 17, 1892, pp. 217–221.

¹ Ridgway, *Color Standards and Color Nomenclature*, 1912 (= January 16, 1913), Washington, D. C.

² Oberholser, *Bull. U. S. Nat. Mus.*, No. 86, April 6, 1914, p. 2.

MEYER, A. B., and WIGLESWORTH, L. W.—The Birds of Celebes and the Neighbouring Islands, vol. 1, 1898, pp. 279–283.

HARTERT, ERNST.—Die Vögel der Paläarktischen Fauna, vol. 2, pt. 1, February, 1912, pp. 886–887.

The present species is very distinct from all of its allies, and easily recognizable by its nearly uniform rufous plumage. The female in color closely resembles the male, is of about the same size, and sometimes is not with certainty distinguishable. It differs, however, usually in being rather duller above, with a less pronounced tinge of magenta, and somewhat lighter below. There is apparently more evidence of the latter difference in some subspecies than in others.

The fully grown juvenal plumage differs from the adult stage as follows: Upper portion of head and body darker and duller, usually with little or no wash of magenta, the back, scapulars, rump, and lower cervix, dark sooty brownish or even somewhat blackish (in *Entomothera coromanda rufa* with as heavy a wash of magenta as the adult); median metallic rump feathers rich bright sapphire blue; wings and tail darker, duller, partly sooty brownish, with generally much less tinge of magenta; sides of head darker and duller, usually without magenta wash, the auriculars plain dark, more or less sooty, brown, the subocular and subauricular regions ochraceous, commonly mixed with whitish and spotted with dusky brown; sides of neck dusky brownish or blackish; lower surface, including the lining of wing, usually much paler, the throat more extensively whitish, the lower breast, abdomen, and crissum in nearly all the races very pale, even partly whitish, the breast very dull tawny; breast very thickly, abdomen more sparingly, marked with squamate feather-tips of dark brown or blackish; bill more or less dusky.

The “first autumn,” or rather post-juvenal, plumage is in most respects more like the adult, from which it differs in nearly or quite lacking the magenta tinge of upper parts; in having sapphire blue median rump feathers; paler, often even partly whitish, lower surface; and dusky edgings to most of the feathers of throat, breast, and upper abdomen. These dark margins comparatively soon wear off, but the bird does not acquire the richly colored fully adult plumage until it is at least a year old, probably just before its first breeding season. The broad light stripe on the middle portion of lower back and rump, though usually silvery whitish, sometimes blue, in the adult, is always blue in the immature bird.

The molt of this species is not well illustrated by the series of specimens at hand. There are only two dated examples in molt: A male *Entomothera coromanda ochrothorectis*¹ (No. 22175, J. H. Fleming), taken, December 5, 1909, at Rio Butas, Mindoro Island, Philippine Islands, in post-juvenal plumage, just passing into the adult state;

¹ See p. 652.

and an adult male *Entomothera coromanda ochrothorectis*¹ (No. 233081, U.S.N.M.) taken, November 6, 1892, at Palanoc, Masbate Island, Philippine Islands, of which the wing-quills and tail-feathers are still partly in sheaths.

Individual variation in the adult bird consists chiefly in the color of the broad light median stripe of the lower back and rump, which ranges from (usually) silvery bluish white to (rarely) light turquoise blue; the amount and brilliancy of the magenta suffusion on the upper surface; the amount of magenta wash on the breast; the extent and paleness of the light color on the chin; and less conspicuously, the depth of the color of the lower surface. The range of individual variation seems hitherto to have been very little understood and to have been consequently considered much greater than it really is, for not a few of the differences due to sex, as well as to age and even geographical variation, have been accredited to this.

The principal characters which separate the subspecies of *Entomothera coromanda* consist in size, depth of color above and below, as well as the amount of magenta tinge present on both upper and lower surfaces. The color of the blue or whitish stripe on the rump seems also to be a subspecific character in some cases, though in others it amounts merely to individual variation.

The faunal distribution of *Entomothera coromanda* as a species lies chiefly within the Oriental Region, though it reaches also the southeastern edge of the Palaearctic Region. Geographically it ranges north to Japan, Korea, and Manchuria; west to eastern Nepal, Burma, and the Malay Peninsula; south to the Barussan Islands² and Java; and east to Borneo, Celebes, the Xulla Islands, Sangi Islands, and the Philippine Islands.

The number of snbspecies here recognized is nine, of which only one is continental in distribution. As is so frequently the case with wide-ranging and plastic species, some of the far-separated races resemble each other more than they do the intervening forms. Thus, *Entomothera coromanda rufa*, from Celebes, is much more like *Entomothera coromanda mizorhina*³ from the Andaman Islands than like *Entomothera coromanda coromanda* of the Malay Peninsula. Similarly *Entomothera coromanda ochrothorectis*¹ from the Philippine Islands more closely resembles *Entomothera coromanda major* from Japan than it does *Entomothera coromanda bangsi*⁴ of the intervening Riu Kiu Islands. Also, *Entomothera coromanda pagana*⁵ from the Pagi Islands is more like *Entomothera coromanda minor* from Borneo, in color at least, than it is like *Entomothera coromanda neophora*⁶ on the neighboring and intermediate island of Sumatra.

¹ See p. 652.² The chain of islands along the western coast of Sumatra.³ See p. 645.⁴ See p. 654.⁵ See p. 648.⁶ See p. 646.

The ruddy kingfisher is apparently a strictly resident species wherever found, with the possible exception of Japan, though it is known to winter even there, and we are aware of no authentic records of the Japanese race, *Entomothera coromanda major*, outside its known breeding range. In habits the bird is shy, living along the streams and about lakes and mangrove swamps near the coast, though found also in the forests away from water.

The present species is without much doubt generically distinct from *Alcedo senegalensis* Linnaeus, the type of *Halcyon* Swainson. It differs from *Halcyon senegalensis* as follows: Bill much larger in every way (relatively as well as actually); exposed culmen about half the length of the wing instead of much less as in *Halcyon senegalensis*; tip of culmen more distinctly decurved; gonys more up-curved; culmen less sharply ridged; gonys less sharply keeled; scutellae of tarsus much smoother; and first (outermost) primary much shorter than the seventh, at most not longer than the eighth. The proper generic designation for this group is *Entomothera* Horsfield,¹ the type of which is, by subsequent designation,² *Alcedo coromanda* Latham. This name is commonly cited from Horsfield's paper, Systematic Arrangement and Description of Birds from the Island of Java, published in the Transactions of the Linnaean Society of London, volume 13, May, 1821, but here the name occurs thus:

"This section [section 2] of the genus *Alcedo* (to the individuals of which the denomination of *Entomotheræ* 'Chasseurs' may be applied) holds a situation intermediate between *Alcedo* and *Dacelo*."³

The species included by Horsfield in this group are as follows:

Alcedo tridactyla LINNAEUS (= *Ceyx tridactylus* [LINNAEUS]).

Alcedo leucocephala GMELIN (= *Ramphalcyon capensis javana* [BODDAERT]).

Alcedo coromanda LATHAM (= *Entomothera coromanda* [LATHAM]).

Alcedo chlorocephala GMELIN (= *Sauropatis chloris* [BODDAERT]).

Alcedo sacra GMELIN (= *Sauropatis sacra* [GMELIN]).

Alcedo melanoptera HORSFIELD (= *Entomothera melanoptera* [HORSFIELD]).

It is evident from the above that "*Entomotheræ*" is only a plural group term, and therefore uncitable as a generic name. The next year, however, Horsfield again refers to the matter,¹ this time applying the name *Entomothera* to the group previously designated by him as "*Entomotheræ*." The generic name *Entomothera* thus becomes available, but dates from the later place of publication.¹

¹ Horsfield, Zoological Researches in Java and the Neighbouring Islands, 1822 (text to *Alcedo biru*).

² Sharpe, Monograph Alcedin., vol. 1, 1871, p. xiii.

³ Trans. Linn. Soc. London, vol. 13, pt. 1, May, 1821, p. 173.

ENTOMOTHERA COROMANDA COROMANDA (Latham).

[*Alcedo*] *coromanda* LATHAM, Index Ornith., vol. 1, 1790, p. 252 ("Coromandela" [India]) (based on *Le Martin Pêcheur violet de la côte de Coromandel*, Sonnerat, Voyage Indes Orient., vol. 2, 1782, p. 212, pl. 118).

Halcyon. *Coromandelicus* VIGORS, in Raffles' Mem. Life and Pub. Serv. Raffles, 1830, p. 654 (nom. emend. pro *Alcedo coromanda* Latham).

[*Halcyon*] *lilacina* SWAINSON, Classif. Birds, vol. 2, 1837, p. 335 (intended to be based on the same plate of Sonnerat's as is *Alcedo coromanda* Latham, but misquoted as "pl. 218").

A[leyon]. *calipyga* HODGSON, in Gray's Zool. Misc., No. 3, June, 1844, p. 82 [Nepal] (*nomen nudum*).

Halcyon coromandra GRAY, Cat. Spec. and Draw. Mamm. and Birds Nepal and Thibet Pres. Hodgson Brit. Mus., 1846, p. 56 (nom. emend. pro *Alcedo coromanda* Latham) (Nepal).

H[alcyon]. *coromandeliana* ("Scopoli"¹) GRAY, Gen. Birds, vol. 1, August, 1846, p. 79 (based on Sonnerat, Voyage Indes Orient., vol. 2, 1782, pl. 118; *Alcedo coromanda* Gmelin; and *Halcyon lilacina* Swainson).

H[alcyon]. *coramander* BLYTH, Cat. Birds Mus. Asiatic Soc., 1849, p. 47 (nom. emend. pro *Alcedo coromanda* Latham) (Tenasserim).

H[alcyon]. *callipyga* SHARPE, Cat. Birds Brit. Mus., vol. 17, 1892, p. 219 (nom. emend. pro *Aleyon calipyga* Hodgson).

Chars subsp.—Size medium; coloration pale, both above and below; forehead and breast with but a slight wash of magenta or with none.

Description.—Adult male, No. 153798, U.S.N.M.; Tyching, Trong, Lower Siam, April 24, 1896; Dr. W. L. Abbott. Upper surface, including sides of head and neck, cinnamon rufous, rather darker on wings and tail; everywhere, except on forehead, cheeks, lores, and orbital region, more or less suffused with magenta, most conspicuously on back, scapulars, nape, and wing-coverts; a long, broad stripe on the middle of the rump and lower back, silvery bluish white; lower parts, including lining of wings, tawny ochraceous, deepening into tawny on the sides of the breast, paling to very light ochraceous buff on the chin, and to ochraceous buff on the middle of abdomen; "orbital ring orange; bill red; feet red; claws orange yellow."

Measurements.—Male: Total length² (in flesh), 247.6 mm.

Probable male³: Wing, 111.5–119 (average, 116.5) mm.; tail, 63–67 (65.1); exposed culmen, 50–53 (51.7); tarsus, 14.5–17 (16.2); middle toe, 17.5–19 (18.5).

Probable female:⁴ Wing, 110.5 mm.; tail, 66; exposed culmen, 50; tarsus, 16; middle toe, 18.3.

Type-locality.—Rangoon, Pegu.⁵

¹ An erroneous supposition that *Alcedo coromandeliana* Scopoli (Del. Flor. et Faun. Insubr., part 2, 1786, p. 89) is the same as *Alcedo coromanda* Latham; whereas its description does not fit at all, being that of some species of *Merops*, probably *Merops viridis* Linnaeus, though Scopoli quotes Sonnerat's Voyage Indes Orient., p. 212, pl. 118.

² One specimen.

³ Six specimens, from southern China, northern India, and the Malay Peninsula.

⁴ One specimen, from the Malay Peninsula.

⁵ Here for the first time definitely fixed.

Geographical distribution.—Permanently resident and breeding from sea level up to an altitude of about 5,000 feet in southeastern Asia, north to Amoy in southeastern China, Assam, Sikkim, and eastern Nepal; west to eastern Nepal, the Sundarbans, Burma, Tenasserim, and the Malay Peninsula; south to Malacca, southern Malay Peninsula; east to the eastern coast of the Malay Peninsula, to French Indo-China, and southeastern China.

Remarks.—This is the lightest-colored of the races of *Entomothera coromanda*, with the exception of *Entomothera coromanda ochrotho-rectis*,¹ though it is not much lighter than the Japan bird, *Entomothera coromanda major*.

It seems to have a wider geographical range than any other form of the species, and exhibits but little variation due to locality. With proper allowance for differences of age and sex, there is not a great amount of individual variation in this subspecies. A single adult from Amoy, China (No. 85712, U.S.N.M.), without doubt belongs here. Birds from Malacca are, as careful comparison shows, clearly referable to the present race, not to *Entomothera coromanda minor*, which, curiously enough, is the form of Singapore.

The earliest name for this species, and consequently for its typical subspecies, is *Alcedo coromanda* Latham,² based on "Le Martin Pêcheur violet de la côte de Coromandel" of Sonnerat,³ supposedly from the Coromandel coast of southern India. The species, however, does not, so far as known, occur anywhere in the southern part of the peninsula of India, hence Sonnerat's locality is evidently wrong. In all probability the bird described and figured by Sonnerat really came from some other part of India, as already asserted by Dr. Ernst Hartert,⁴ though Dr. R. B. Sharpe thinks that it "most likely" came from Malacca.⁵ I do not, however, consider that the latter expression of opinion is definite enough to be regarded as fixation of the type locality. In making the present division of the species into races it is of considerable importance to have a definite type locality for the typical subspecies, *Entomothera coromanda coromanda*. Sonnerat's description³ of his "Martin Pêcheur violet de la côte de Coromandel" is so worded that it furnishes no means of determining to which of the several races it applies; and in view of this Doctor Hartert was justified in restricting it to the bird of the Indian mainland. Furthermore, in order to make this restriction as definite as possible, we select as the type locality Rangoon, in Pegu, a place which Sonnerat visited.

¹ See p. 652.

² Index Ornith., vol. 1, 1790, p. 252.

³ Voyage Indes Orient., vol. 2, 1782, p. 212, pl. 118.

⁴ Vogel pal. Fauna, vol. 2, pt. 1, February, 1912, p. 886.

⁵ Mon. Alcedinidae, vol. 2, 1870, p. 156.

Measurements of specimens of *Entomothera coromanda coromanda*.

Museum and No.	Sex.	Locality.	Date.	Collector.	Total length. ¹	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
					mm.	mm.	mm.	mm.	mm.	mm.
J.H.Fleming 2822 ²	[Male]...	Sikkim.....			.....	111.5	66.5	52	16	17.5
U.S.N.M. 101992 ²	[Male]...	do.....	June—, 1873		.....	114	63	53	17	19
U.S.N.M. 101993 ²	[do.]...	Darjiling, northeast- ern India.			.....	119	65	50.5	16.5	18.5
U.S.N.M. 85712 ²	[do.]...	Amoy, China.			.....	118.5	.....	51.5	.....	.....
U.S.N.M. 101995 ²	[do.]...	Malacca, southern Malay Pen- insula.			.....	117.5	67	50	17	19
U.S.N.M. 163798 ²	Male....	Tyching Trong, Lower Siam.	Apr.24, 1896	W. L. Ab- bott.	247.6	118.5	64	53	14.5	18.5
A.N.S.P. 21305 ²	[Female]	Malacca, southern Malay Pen- insula.			.....	110.5	66	50	16	18.3
J.H.Fleming 4283..	Vix ad..	Darjiling, northeast- ern India.	Aug.—, 1870	W. T. Blan- ford.	.....	111	68	47	16.5	20
U.S.N.M. 101994...	Vix ad..	India.....		A. Anderson	.....	113.5	59	44	16	18

¹ Measured in the flesh by the collector.
² Used in measurement averages on p. 643.

ENTOMOTHERA COROMANDA MIZORHINA, new subspecies.

Chars. subsp.—Similar to *Entomothera coromanda coromanda*, but bill much bigger; tarsus and middle toe somewhat longer; upper and lower parts much darker; and both breast and forehead more washed with magenta.

Description.—Type, adult [probably a male], No. 19247, collection of J. H. Fleming; North Andaman Island, Andaman Islands, January, 1905; C. Anderson. Upper parts, including sides of head and neck, rather dull cinnamon rufous, the wings and tail darker, between hazel and chestnut brown; everywhere more or less suffused with magenta, most conspicuously so on cervix, crown, back, scapulars, and wing-coverts; a long, broad stripe on the middle of the rump and lower back greenish beryl blue; lower surface mostly cinnamon rufous, paling somewhat on the middle of abdomen and on crissum, passing into ochraceous buff on the chin, and deepening into tawny on the breast and lining of wings; the breast somewhat tinged with magenta.

Measurements.—Probable male:³ Wing, 114.5 mm.; tail, 67; exposed culmen, 58; tarsus, 17.5; middle toe, 20.

Type-locality.—North Andaman Island, Andaman Islands.

Geographical distribution.—Andaman Islands, and probably also the Nicobar Islands.

Remarks.—Although we have examined but two specimens of this new race, there is such a remarkable difference in the size of the bill

³ One specimen, the type.

as compared with even the largest forms of the species that we have no hesitancy at all in separating it subspecifically. In color, however, it superficially very much resembles *Entomothera coromanda rufa*, from Celebes, much more so, indeed, than it does *Entomothera coromanda coromanda* from the adjacent Malay Peninsula. To this resemblance Doctor Hartert has already called attention.¹

The juvenal plumage of *Entomothera coromanda mizorhina* is much darker, both above and below, than that of *Entomothera coromanda coromanda*.

The difference between birds from the Andaman Islands and the mainland of India (Sikkim and Tenasserim) has already been noted by Hume.²

Measurements of specimens of Entomothera coromanda mizorhina.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
J. H. Fleming 19247. ³	[Male] ⁴ .	North Andaman Island, Andaman Islands.	Jan. —, 1905	C. Anderson.	mm. 114.5	mm. 67	mm. 58	mm. 17.5	mm. 20
J. H. Fleming 19248.	Juv.	Rutland, South Andaman Island, Andaman Islands.	Oct. 9, 1905	B. B. Osmonston.	111	68	59	19	21.5

³ Used in measurements on p. 645.

⁴ Type.

ENTOMOTHERA COROMANDA NEOPHORA, new subspecies.

Chars. subsp.—Resembling *Entomothera coromanda coromanda*, but wing and tail decidedly shorter; lower parts darker; and breast more washed with magenta.

Description.—Type, adult male, No. 179191, U.S.N.M.; Tapanuli Bay, northwestern Sumatra, February 19, 1902, Dr. W. L. Abbott. Upper parts, including sides of head and neck, rather dull cinnamon rufous, the wings and tail darker, between hazel and chestnut brown; everywhere more or less suffused with magenta, most conspicuously on cervix, back, scapulars, and wing-coverts; a long, broad stripe on the median portion of rump and lower back, silvery bluish white; breast and lining of wings cinnamon rufous, the former slightly washed with magenta; chin light ochraceous buff; remainder of lower surface light cinnamon rufous, palest on the middle portion of abdomen; "iris dark brown; eyelids red; feet and bill red."

Measurements.—Male:⁵ Total length (in flesh), 254–255 (average, 254.5) mm.; wing, 100–103.5 (101.8); tail, 58.5–62 (60.3); exposed culmen, 50–51.5 (50.8); tarsus, 14.8–15.8 (15.3); middle toe, 17–19.5 (18.3).

¹ Vogel pal. Fauna, vol. 2, pt. 1, February, 1912, p. 887.

² Stray Feathers, vol. 3, January, 1874, p. 169; October, 1874, p. 494.

⁵ Two specimens, from western Sumatra and eastern Sumatra.

Female:¹ Total length (in flesh), 251 mm.; wing, 103–111 (average, 107²); tail, 58.5–62.5 (60.5); exposed culmen, 52.5–54.5 (53.5); tarsus, 17; middle toe, 19.2–20.5 (19.9).

Type-locality.—Tapanuli Bay, northwestern Sumatra.
Geographical distribution.—Sumatra; and probably also the island of Banka.

Remarks.—This new race is readily distinguishable from *Entomothera coromanda mizorhina*, of the Andaman Islands, by reason of its much smaller size, decidedly paler lower parts, somewhat lighter upper surface, and less heavy magenta wash on the breast. These color differences appear to obtain in both young and adult. The juvenal plumage appears to be very similar in color to the same stage of *Entomothera coromanda coromanda*. One specimen, from Sumatra, but without date, in the United States National Museum (No. 113027), is in rather peculiar transition plumage. It is apparently a male, which has acquired the dark under surface, magenta-washed breast, heavily magenta-tinged cervix, back, and sides of neck, which characterize the adult; but still retains the deep blue rump, dull brownish crown, dull brownish wings and scapulars of the juvenal plumage.

Specimens of *Entomothera coromanda* from Sumatra have heretofore been considered identical with those from Borneo, but present comparison shows them to be subspecifically different. Since the type locality of apparently the only name that could by any possibility apply to the Sumatra form, *Alcedo coromanda minor* Temminck and Schlegel³, is Borneo, as hereinafter shown,⁴ the Sumatra bird requires a new designation, which we have provided above.

Measurements of specimens of *Entomothera coromanda neophora*.

Museum and No.	Sex.	Locality.	Date.	Collector.	Total length. ⁵	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
U.S.N.M. 179191 ⁶	Male ⁷ ...	Tapanuli Bay, western Sumatra.	Feb. 19, 1902	W. L. Abbott.	mm. 254	mm. 100	mm. 62	mm. 50	mm. 14.8	mm. 17
U.S.N.M. 181097 ⁶	...do....	Rupat Strait, eastern Sumatra.	Mar. 2, 1906	.....do.....	255	103.5	58.5	51.5	15.8	19.5
U.S.N.M. 179192 ⁶	Female, vix ad.	Tapanuli Bay, western Sumatra.	Feb. 20, 1902	.....do.....	251	111	62.5	54.5	17	19.2
U.S.N.M. 181096 ⁶	Female, juv. ⁸	Aru Bay, eastern Sumatra.	Dec. 11, 1905	.....do.....	.....	103	58.5	52.5	17	20.5
U.S.N.M. 113027...	[Male, vix ad.]	Sumatra.....	.....	.....	.....	99	58	52.3	.....	.....

¹ Two specimens, from western Sumatra and eastern Sumatra.
² Probably much too high, due to the abnormally large size of one of the two specimens measured.
³ Fauna Japonica, 1842, p. 76.
⁴ See p. 650.
⁵ Measured in the flesh by the collector.
⁶ Used in measurement averages on pp. 646–647.
⁷ Type.
⁸ Full-grown, though in juvenal plumage.

ENTOMOTHERA COROMANDA PAGANA, new subspecies.

Chars. subsp..—Similar to *Entomothera coromanda neophora*, from Sumatra, but wing and tail averaging longer; lower parts and also upper parts darker.

Description..—Type, adult male, No. 179762, U.S.N.M.; North Pagi Island, western Sumatra, January 4, 1903; Dr. W. L. Abbott. Upper surface, including sides of head and neck, rather dull cinnamon rufous, the wings and tail darker, between hazel and chestnut brown; everywhere more or less suffused with magenta, most brightly on cervix, crown, back, scapulars, and wing-coverts; a long, broad stripe on the middle of the rump and lower back, silvery bluish white; lower parts chiefly cinnamon rufous, paling somewhat medially on the posterior portion, passing into ochraceous buff on the chin, and deepening to tawny on the breast and lining of wings; the breast somewhat washed with magenta; "bill and feet coral."

Measurements..—Male:¹ Total length (in flesh), 260 mm.; wing, 107; tail, 62.5; exposed culmen, 50; tarsus, 15; middle toe, 19.5.

Female:² Total length (in flesh), 253–270 (average, 261.5) mm.; wing, 105–106 (105.5); tail, 64–66.5 (65.3); exposed culmen, 52.5–53 (52.8); tarsus, 16; middle toe, 18.5–20 (19.3).

Type-locality..—North Pagi Island, Pagi Islands, northwestern Sumatra.

Geographical distribution..—The Pagi Islands and the Batu Islands, of the Barussan chain, off western Sumatra.

Remarks..—Additional material and a better understanding of the various forms of *Entomothera coromanda*, particularly those from Sumatra, Singapore, and the Malay Peninsula, show that the bird from the Pagi Islands, probably including also that of the Batu Islands, off the western coast of Sumatra, is an undescribed subspecies. The only example from the Batu Islands is in post-juvenal plumage, but it seems to belong to the same race as birds from the Pagi Islands. It is practically identical in color with a bird from the Andaman Islands (No. 19248, J. H. Fleming, Rutland, South Andaman Island, October 9, 1905), in corresponding plumage, though if anything rather darker.

The present subspecies is, in both adult and juvenal plumages, practically identical in color with *Entomothera coromanda mizorhina* of the Andaman Islands, but is distinguishable by its much smaller size, particularly of the bill.

¹ One specimen, from North Pagi Island, western Sumatra.

² Two specimens, from North Pagi Island, western Sumatra.

Measurements of specimens of *Entomothera coromanda pagana*.

Museum and No.	Sex.	Locality.	Date.	Collector.	Total length. ¹	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
U.S.N.M.179762 ² .	Male ³ ...	North Pagi Island, Pagi Islands, western Sumatra.	Jan. 4, 1903	W. L. Abbott.	mm. 260	mm. 107	mm. 62.5	mm. 50	mm. 15	mm. 19.5
A.N.S.Phila.56146	Male, juvenal.	Pulo Tana Masa, Batu Islands, western Sumatra.	Aug. 13, 1896	J. Z. Kannegieter.	.....	102	61	48.5	16	17.8
U.S.N.M.179763 ² .	Female.	North Pagi Island, Pagi Islands, western Sumatra.	Jan. 6, 1903	W. L. Abbott.	253	105	66.5	53	16	18.5
U.S.N.M.179761 ².	...do.....	...do.....	Jan. 1, 1903	...do.....	270	106	64	52.5	16	20

¹ Measured in the flesh by the collector.
² Used in measurement averages on p. 648.
³ Type.

ENTOMOTHERA COROMANDA MINOR (Temminck and Schlegel).

Alcedo (Halcyon) coromanda minor TEMMINCK and SCHLEGEL, Fauna Japonica, 1842, p. 76 (Borneo and Sumatra).

Chars. subsp.—Resembling *Entomothera coromanda pagana*, but wing shorter; and lower surface, particularly the posterior portion, darker.

Measurements.—Male:⁴ Total length (in flesh), 247–254 (average, 250.5) mm.; wing, 98.5–103 (100.3); tail, 59–61.5 (60.2); exposed culmen, 48.5–52.5 (50); tarsus, 15–16 (15.6); middle toe, 17.5–18.5 (17.8).

Female:⁵ Wing, 100–104 (102) mm.; tail, 58–62 (60); exposed culmen, 51–51.5 (51.3); tarsus, 15.5–16 (15.8); middle toe, 19.3–19.5 (19.4).

Type-locality.—Pontianak, Borneo.⁶

Geographical distribution.—Borneo, together with Labuan and doubtless other of its coastal islands; Tawi Tawi Island, Philippine Islands; Singapore Island; and probably Java.

Remarks.—The principal characters which separate the present form from *Entomothera coromanda coromanda*, dark coloration and small size, have had notice from several authors, but since the original description of *Entomothera coromanda minor*,⁷ not until 1912⁸ did they receive due formal recognition. However, a very marked difference in both size and color is at once observable on comparison of specimens from northeastern India and from Borneo. In addition

⁴ Three specimens, from Borneo and Singapore Island.
⁵ Two specimens, from Borneo and Labuan Island.
⁶ Here for the first time definitely restricted. See p. 650.
⁷ *Alcedo (Halcyon) coromanda minor* Temminck and Schlegel, Fauna Japonica, 1842, p. 76.
⁸ Hartert, Vögel pal. Fauna, vol. 2, pt. 1, February, 1912, p. 887.

to the generally darker coloration, the breast of *Entomothera coromanda minor* is more suffused with magenta than in *Entomothera coromanda coromanda*. The Borneo race is also much darker both above and below than is *Entomothera coromanda neophora* from Sumatra, with more magenta suffusion on the breast, and, furthermore, averages slightly smaller. It is smaller than *Entomothera coromanda pagana*, and has darker lower parts. The colors of the unfeathered portions, taken from a Singapore specimen, are as follows: "Iris dark brown; eyelids, bill, and feet red."

Birds from the island of Singapore are apparently the same as those from Borneo, if anything a little darker; and thus decidedly different from the light-colored *Entomothera coromanda coromanda* from Malacca on the near-by mainland of the Malay Peninsula. This bears out what we have noted in some other groups of birds regarding the tendency of Singapore to have faunal affinity with Sumatra or Borneo rather than with the Malay Peninsula, a very interesting fact, in view of the proximity of the Malay Peninsula and the comparative remoteness of both Sumatra and Borneo. A single immature specimen from Tataän, on Tawi Tawi Island, in the southwestern part of the Philippine Archipelago, is apparently typical of *Entomothera coromanda minor*.

The only name applicable to the present subspecies is *Alcedo* (*Halcyon*) *coromanda minor* Temminck and Schlegel.¹ This was based on specimens from Borneo and Sumatra, but without designation of type or type locality. By reason of the present subspecific separation of the Sumatra bird from that of Borneo,² it becomes necessary to restrict the name *Alcedo coromanda minor* to one or the other of these. In order to determine, if possible, which locality Doctor Schlegel considered typical, I wrote to Dr. E. D. van Oort, who is now in charge of the famous ornithological collection of the Leyden Museum, asking if the type of *Alcedo coromanda minor* was in the museum. His reply is as follows:

The type-specimens of '*Dacelo coromandeliana minor*' Schlegel are the three ones mentioned on page 26 of Schlegel's Catalogue of the 'Alcedines' of the Mus. d'Hist. Nat. des Pays-Bas. None of them is marked by him as 'type.'

Since the two most important characters given by Temminck and Schlegel¹ to separate their *Alcedo coromanda minor* from their *Alcedo coromanda major* of Japan—small size and dark rich coloration—best apply to the bird from Borneo, it therefore seems best to fix on this the name *Alcedo coromanda minor*; and we accordingly designate Pontianak, Borneo, as the type locality, which is the locality of the second of the three specimens catalogued by Schlegel,³ as mentioned above in the quotation from Dr. E. D. van Oort.

¹ Fauna Japonica, 1842, p. 76.

² See p. 646.

³ Mus. d'Hist. Nat. Pays-Bas, vol. 3, Mon. 17, Alcedines, 1863, p. 26.

Measurements of specimens of *Entomothera coromanda minor*.

Museum and No.	Sex.	Locality.	Date.	Collector.	Total length. ¹	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
U.S.N.M. 181696 ²	Male....	Pasir, eastern Borneo.	Jan. 15, 1909	W. L. Abbott.	mm. 247	mm. 98.5	mm. 59	mm. 49	mm. 15.7	mm. 17.5
U.S.N.M. 170448 ²	...do....	Selitar, 9 miles from Singapore, Singapore Island, Straits Settlements.	May 18, 1899	.....do.....	254	99.5	60	52.5	16	18.5
U.S.N.M. 15908 ²	[Male]...	Singapore, Singapore Island.	.....	U.S. Expedition to Japan.	.....	103	61.5	48.5	15	17.5
U.S.N.M. 181906 ²	Female.	Segah River, eastern Borneo.	Dec. 3, 1912	H.C. Raven	.....	100	58	51.5	15.5	19.5
U.S.N.M. 145136 ²	[Female]	Labuan Island, northern Borneo.	— —, 1877	H. Low ...	.....	104	62	51	16	19.3
U.S.N.M.	Female juvenal. ³	Tataán, Tawi Tawi Island, Philippine Islands.	Oct. 30, 1891	D. C. Worcester and F. S. Bourns.	.....	102	59.5	49.5	17	18

¹ Measured in the flesh by the collector. ² Used in measurement averages on p. 649. ³ Full grown.

ENTOMOTHERA COROMANDA RUFA (Wallace).

Halcyon rufa WALLACE, Proc. Zool. Soc. Lond., 1862, p. 338 (Makassar, Celebes).

Chars. subsp.—Much like *Entomothera coromanda minor*, but decidedly larger throughout; sides and flanks more noticeably washed with magenta; and median light stripe of lower back and rump darker, more bluish.

Measurements.—Male:⁴ Wing, 107 mm.; tail, 68.5; exposed culmen, 46.5; tarsus, 17.7; middle toe, 20.2.

Female:⁵ Wing, 112–113 (average, 112.5) mm.; tail, 67; exposed culmen, 53.5–54 (53.8); tarsus, 16.5–18 (17.3); middle toe, 19–20 (19.5).

The following measurements are abstracted and averaged from Meyer and Wiglesworth's table,⁶ juvenal and immature birds omitted, and no distinction made with regard to sex:⁷

Wing, 110–127 (average, 117.2)⁸ mm.; tail, 68–75 (71); bill from nostril, 43–51 (47.6); tarsus, 15–18 (16.3).

Type-locality.—Makassar, Celebes.

Geographical distribution.—Celebes and neighboring islands: North to the Sangi and Talaut Islands; and east to the Xulla Islands; including the Peling Islands, the Togian Islands, and the islands of Buton, Talissi, and Lembeh.

Remarks.—While I have been unable to examine a large series of specimens of this form, and have taken its measurements chiefly from Meyer and Wiglesworth,⁶ it has been so well described by other

⁴ One specimen, from Celebes.
⁵ Two specimens, from Celebes.
⁶ Birds of Celebes, vol. 1, 1898, p. 281.
⁷ Seventeen specimens, from Celebes and its islands.
⁸ The apparent great wing-length of these specimens may be due, in part at least, to a different method of measuring.

authors that there is no doubt of its distinctness. It so greatly exceeds *Entomothera coromanda minor* in size that there is no difficulty at all in distinguishing it, even though in color it appears not to differ to any important extent. From both *Entomothera coromanda coromanda* and *Entomothera coromanda major* it departs conspicuously in its dark rich colors, both above and below. It is, curiously enough, very close in appearance to *Entomothera coromanda mizorhina*, but in the adult differs in having darker lower parts, particularly posteriorly; darker, more bluish light rump-stripe; more heavily magenta-tinged breast, sides, and flanks; and a much larger bill. Immature birds are also darker below than those of the Andaman race. The present subspecies seems to be confined to Celebes and the surrounding islands. Immature birds are very dark, almost as dark as adults, the difference much less than in a majority of the races.

Measurements of specimens of Entomothera coromanda rufa.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
A.N.S.Phila.50104 ¹	Male, vix ad.	Likupang, Celebes.	Sept. —, 1895	C. Hose....	mm. 107	mm. 68.5	mm. 46.5	mm. 17.7	mm. 20.2
J.H.Fleming 11004 ¹	Female..	Bojat, Minahasa, Celebes.	June —, 1899	A. Weigall.	113	67	54	16.5	19
J.H.Fleming 11005 ¹	...do.....	Totok, Minahasa, Celebes.	Jan. —, 1899	.....do.....	112	.....	53.5	18	20

¹ Used in measurement averages on p. 651.

ENTOMOTHERA COROMANDA OCHROTHORECTIS, new subspecies.

Chars. subsp..—Similar to *Entomothera coromanda coromanda*, but decidedly larger throughout, and somewhat less suffused with magenta on the upper surface.

Description..—Type, adult male, No. 233081, U.S.N.M., Palanoc, Masbate Island, Philippine Islands, November 6, 1892; D. C. Worcester and F. S. Bourns; original number, 820. Upper parts, including sides of head and neck, cinnamon rufous, rather darker on wings and tail; everywhere, except on extreme forehead, more or less suffused with magenta, though but slightly on sides of head, most conspicuously on cervix, back, scapulars, and wing-coverts; a long, broad stripe on the middle of the rump and lower back, partly silvery bluish white, somewhat mixed with light turquoise blue; lower surface, including lining of wings, dull tawny ochraceous, deepening into tawny on the sides of the breast, and paling to light buff on the chin, to warm buff and light buff on the middle of the abdomen.

Iris dark brown; bill, legs, and feet, bright scarlet; nails reddish brown.

Measurements..—Male:² Total length (in flesh), 279.4 mm.

Female:² Total length (in flesh), 273.

² One specimen.

Male:¹ Wing, 121–122 (average, 121.5) mm.; tail, 68–70.5 (69.5); exposed culmen, 53–55.5 (53.8); tarsus, 16.2–19 (17.6); middle toe, 19–20.2 (19.8).

Female:² Wing, 119 mm.; tail, 68–72.5 (70.3); exposed culmen, 50.8–55 (52.9); tarsus, 17–17.5 (17.3); middle toe, 19–20 (19.5).

Type-locality.—Palanoc, Masbate Island, Philippine Islands.

Geographical distribution.—Philippine Archipelago. Reported from the following islands: Batan, Calayan, Camiguin, Guimaras, Luzon, Masbate, Mindanao, Mindoro, Palawan, Sibuyan, and Tawi Tawi.

Compared with *Entomothera coromanda rufa* the present race differs in its larger size, paler, less magenta-tinged upper and particularly lower parts, and more whitish rump-stripe. In immature plumage it is also paler, especially below. From *Entomothera coromanda minor* it may be distinguished by its much greater size, lighter coloration, particularly below, and by less suffusion of magenta on breast and upper surface.

This bird seems to be pretty well distributed throughout the Philippine Islands, and permanently resident, though not common. Examples from the various islands appear to be identical. Immature examples of this subspecies are very much paler below than are the adults, the difference comparable to that in *Entomothera coromanda major*.

Measurements of specimens of Entomothera coromanda ochrothorectis.

Museum and No.	Sex.	Locality.	Date.	Collector.	Total length. ³	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
J. H. Fleming 22175. ²	Male, vix ad.	Rio Butas, Mindoro Island, Philippine Islands.	Dec. 5, 1909	J. J. Mounsey.	.....	mm. 121	mm. 70	mm. 53	mm. 19	mm. 20
U.S.N.M. 191457 ⁴	....do....	Pasonanca, Mindanao Island, Philippine Islands.	Dec. 21, 1902	E. A. Mearns.	.....	122	70.5	....	16.2	20.2
U.S.N.M. 233081 ⁴	Male ⁵ ...	Palanoc, Masbate Island, Philippine Islands.	Nov. 6, 1892	D. C. Worcester and F. S. Bourns.	.....	.....	.....	53	17	19
U.S.N.M. 210972 ⁴	Male, vix ad.	Dinampan, Batatan Province, Luzon Island, Philippine Islands.	Nov. 7, 1904	A. Celestino and Canton.	279.4	121.5	68	55.5	18	20
J. H. Fleming 22176. ⁴	Female, vix ad.	Laguna de Naujan, northern Mindoro Island, Philippine Islands.	Dec. 2, 1909	J. J. Mounsey.	.....	119	68	55	17.5	19
U.S.N.M. 210973 ⁴	Female	Calayan Island, Philippine Islands.	Oct. 9, 1903	R. C. McGregor and A. Celestino.	273	.....	72.5	50.8	17	20
M.C.Z. 12168.	Vix ad..	Manila, Luzon Island, Philippine Islands.	.....	.....	.....	123	69	51	16	21.5

¹ Four specimens, from the islands of Luzon, Mindoro, Masbate, and Mindanao.

² Two specimens, from the islands of Mindoro and Calayan.

³ Measured in the flesh by the collector.

⁴ Used in measurement averages on p. 653.

⁵ Type.

ENTOMOTHERA COROMANDA BANGSI,¹ new subspecies.

Chars. subsp.—Resembling *Entomothera coromanda ochrothorectis*, but tail decidedly longer; bill shorter; coloration darker, particularly below; upper parts and breast more brightly suffused with magenta.

Description.—Type, adult male, No. 40990, Museum of Comparative Zoölogy; Ishigaki Island, Yaeyama Group, Riu Kiu Islands, Japan, April 23, 1899; Ishidi Zensaku. Upper surface, including sides of head and neck, rather dull cinnamon rufous, the wings and tail darker, between hazel and chestnut brown; everywhere more or less suffused with magenta, most conspicuously on cervix, crown, back, scapulars, and wing-coverts; a long, broad stripe on the middle of the rump and lower back, silvery bluish white; lower parts mostly cinnamon rufous, paling somewhat on the median portion posteriorly, passing into ochraceous buff on the chin, and deepening to tawny on the breast and lining of wings; the breast somewhat tinged with magenta.

Measurements.—Male:² Wing, 117.5–126.5 (average, 123.6) mm.; tail, 68–79 (74.8); exposed culmen, 48–56.5 (52); tarsus, 16.3–18.5 (17.5); middle toe, 19–22 (20.9).

Female:³ Wing, 117.5–123.5 (121.5) mm.; tail, 72.5–75 (74.3); exposed culmen, 46.5–55 (50); tarsus, 16.8–18 (17.4); middle toe, 19–21.3 (20.2).

Type-locality.—Ishigaki Island, Yaeyama Group, Riu Kiu Islands, Japan.

Geographical distribution.—Riu Kiu Islands, Japan, and probably also the island of Formosa.

Remarks.—This new race is of practically the same colors throughout as is *Entomothera coromanda mizorhina* from the Andaman Islands, but has a much longer wing and tail, with a decidedly shorter culmen. It resembles *Entomothera coromanda minor*, but is much larger throughout, and has somewhat paler lower parts with less of a magenta wash on the breast. Compared with *Entomothera coromanda rufa* it is larger, lighter on the lower surface, with less of magenta tinge on breast, sides, and flanks, and has a paler bluish rump-stripe. Dr. L. Stejneger many years ago noticed⁴ the difference between the birds from the Riu Kiu Islands and those from Japan, but for lack of material was unable satisfactorily to work out their relationships.

In this fine series of 20 adults there is comparatively little individual variation. Some specimens, however, have a more conspicuous

¹ Named for Mr. Outram Bangs, through whose kindness the writer is privileged to publish the present description.

² Fifteen specimens, from the Riu Kiu Islands, Japan.

³ Five specimens, from the Riu Kiu Islands, Japan.

⁴ Proc. U. S. Nat. Mus., vol. 10, 1887, p. 403.

magenta suffusion on the breast; others are more brilliantly magenta on the upper surface; and there is some difference in the general depth of the rufous color both above and below. The most important variation exists in the broad light stripe on the median portion of the rump, which is in some examples silvery white, in others light turquoise blue. As in other races of the species, the females are somewhat lighter and duller than the males.

Measurements of specimens of *Entomothera coromanda bangsi*.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
					mm.	mm.	mm.	mm.	mm.
M.C.Z. 40990 ¹	Male ² ...	Ishigaki Island, Riu Kiu Islands, Japan.	Apr. 23, 1899	I. Zensaku..	122.5	75	53	17	19
M.C.Z. 40991 ¹	do.....	do.....	do.....	do.....	123	74	55	18.5	21
M.C.Z. 40995 ¹	do.....	do.....	Apr. 30, 1899	do.....	123	75	55	18	21.5
M.C.Z. 40994 ¹	do.....	do.....	do.....	do.....	122.5	77	48	16.5	20.2
M.C.Z. 40988 ¹	do.....	do.....	Apr. 6, 1899	do.....	126.5	79	52.2	18.2	21.5
M.C.Z. 40989 ¹	do.....	do.....	Apr. 20, 1899	do.....	124	77	52	17	19.5
M.C.Z. 40992 ¹	do.....	do.....	Apr. 23, 1899	do.....	120.5	75	48.5	17	20.5
M.C.Z. 40993 ¹	do.....	do.....	Apr. 25, 1899	do.....	125.8	75.2	53.2	17.5	21
M.C.Z. 37361 ¹	do.....	do.....	do.....	do.....	124.8	76	51	16.3	20.5
M.C.Z. 40997 ¹	do.....	do.....	June 1, 1899	do.....	124.8	78	49.2	17	22
M.C.Z. 40996 ¹	do.....	do.....	do.....	do.....	124	68	56.5	18	21.2
M.C.Z. 40999 ¹	do.....	do.....	June 2, 1899	do.....	123	70.5	56.5	17.5	21.5
M.C.Z. 41000 ¹	do.....	do.....	do.....	do.....	117.5	73.5	54	17	22
M.C.Z. 41002 ¹	do.....	do.....	June 7, 1899	do.....	120.5	74	52	18.5	21
M.C.Z. 41003 ¹	do.....	do.....	June 10, 1899	do.....	123.5	75	50	18	21
U.S.N.M. 110972 ..	Male vix ad.	Yaeyama Islands, Riu Kiu Islands, Japan.	Feb. 3, 1887	J. Nishi.....	124.5	75.5	53	17.5	21
M.C.Z. 40986 ¹	Female..	Ishigaki Island, Riu Kiu Islands, Japan.	Apr. 5, 1899	I. Zensaku..	122.5	74.5	55	17	19
M.C.Z. 40987 ¹	do.....	do.....	do.....	do.....	122	75	48	17	19.5
M.C.Z. 37362 ¹	do.....	do.....	Apr. 25, 1899	do.....	123.5	74.5	49.5	18	20.5
M.C.Z. 40998 ¹	do.....	do.....	June 1, 1899	do.....	122	72.5	46.5	18	21.3
M.C.Z. 41001 ¹	do.....	do.....	June 2, 1899	do.....	117.5	75	51	16.8	20.8

¹ Used in measurement averages on p. 654.
² Type.

ENTOMOTHERA COROMANDA MAJOR (Temminck and Schlegel).

Alcedo (Halcyon) coromanda major TEMMINCK and SCHLEGEL, Fauna Japonica, 1842, p. 75, pl. 39 (Japan).
H[alcyon]. schlegeli BONAPARTE, Consp. Avium, vol. 1, 1850, p. 156 (Japan).
Chars. subsp.—Similar to *Entomothera coromanda bangsi*, but tail averaging shorter; coloration lighter, especially on the under surface; breast and upper parts less overlaid with magenta.
Measurements.—Male:³ Wing, 120.5–126 (average, 123) mm.; tail, 69–72 (70.8); exposed culmen, 49–52.5 (50.8); tarsus, 16.5–17.5 (17.1); middle toe, 19–20 (19.6).
Type-locality.—Japan.
Geographical distribution.—Eastern Asia, north to Yezo Island in Japan, Seoul in Korea, and to southern Manchuria; west to the mouth

³ Three specimens, from Japan.

of the Yangtse-Kiang River; south to the mouth of the Yangtse-Kiang River and Kiusiu Island, Japan; and east to Hondo Island, Japan.

Remarks.—This race may readily be distinguished from *Entomothera coromanda minor* by its much greater size, paler colors, and less tinge of magenta on breast and upper surface. From *Entomothera coromanda rufa* it is separable by its greater size, decidedly lighter coloration, both above and below, less magenta tinge on breast, sides, flanks, and upper parts, and more whitish rump-stripe. In immature plumage it is also much paler throughout. It more resembles *Entomothera coromanda ochrothorectis*, but has a slightly longer tail and wing, a somewhat shorter bill, and darker coloration, especially below. This northern race is very similar in color to *Entomothera coromanda coromanda*, and some specimens are scarcely distinguishable in this respect; but its large size is of course distinctive. The characters which serve for the separation of the present race from the other forms of *Entomothera coromanda* have been mentioned by various authors, but usually, at least until within a few years, without being considered of subspecific significance. It has, however, received credit for being paler than it really is, since proper allowance has apparently not been made for differences due to age. In *Entomothera coromanda major* the immature birds are very decidedly paler, particularly below, than are the adults, this difference much greater than in some of the other races of the species; consequently, adult birds are necessary for satisfactory comparisons.

The type-specimen or specimens of this subspecies were obtained in Japan by Doctor Bürger, but are without further locality data.¹

Measurements of specimens of Entomothera coromanda major.

Museum and No.	Sex.	Locality.	Date.	Collector.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
J.H.Fleming 22019 ²	Male, vix ad.	Hakodate, Yezo Island, Japan.	— —, 1902	A. E. Wil- man.	mm. 126	mm. 71.5	mm. 52.5	mm. 17.3	mm. 19
U.S.N.M. 91393 ² ...	do.....	Chiussenji Lake, Japan.	Sept. 2, 1882	P. L. Jouy..	120.5	69	49	16.5	20
U.S.N.M. 110485 ² ..	[Male] vix ad.	Nikko, Japan...	.....	.....do.....	122.5	72	51	17.5	19.8
U.S.N.M. 109404...	Female, vix ad.	Sagami, Japan..	May 9, 1884	.....	118.5	66	44.5	17.5	19.2

¹ See Temminck and Schlegel, *Fauna Japonica*, 1842, pp. 75, 76, pl. 39; Schlegel, *Mus. d'Hist. Nat. Pays-Bas*, vol. 3, Mon. 17, *Alcedines*, 1863, p. 25.

² Used in measurement averages on p. 655.

KEY TO THE SUBSPECIES OF ENTOMOTHERA COROMANDA, BASED ON ADULT MALES.

- a*¹. Larger (wing usually not less than 120 mm.; averaging more than 120 mm.).
 - b*¹. Lighter; and somewhat smaller (wing averaging 121.5 mm.).
 - Entomothera coromanda ochrothorectis* (p. 652).
 - b*². Darker; and somewhat larger (wing averaging about 123.5 mm.).
 - c*¹. Paler, particularly on lower parts; breast and upper surface less overlaid with magenta. *Entomothera coromanda major* (p. 655).
 - c*². Darker, particularly on lower parts; breast and upper surface more overlaid with magenta. *Entomothera coromanda bangsi* (p. 654).
- a*². Smaller (wing usually less than 120 mm.; averaging less than 120 mm.).
 - b*¹. Upper and particularly lower parts lighter.
 - c*¹. Lower surface darker; breast more washed with magenta; size smaller (wing usually less than 110 mm.; averaging 101.8 mm.).
 - Entomothera coromanda neophora* (p. 646).
 - c*². Lower surface paler; breast less or not at all washed with magenta; size larger (wing usually more than 110 mm.; averaging 116.5 mm.).
 - Entomothera coromanda coromanda* (p. 643).
 - b*². Upper and particularly lower parts darker.
 - c*¹. Exposed culmen more than 55 mm. *Entomothera coromanda mizorhina* (p. 645).
 - c*². Exposed culmen less than 55 mm.
 - d*¹. Lower parts lighter. *Entomothera coromanda pagana* (p. 648).
 - d*². Lower parts darker.
 - e*¹. Larger (wing averaging about 117 mm.); sides and flanks more washed with magenta; median stripe of lower back and rump darker, more bluish. *Entomothera coromanda rufa* (p. 651).
 - e*². Smaller (wing averaging 100.3 mm.); sides and flanks less washed with magenta; median stripe of lower back and rump lighter, more whitish. *Entomothera coromanda minor* (p. 649).

REDISCOVERY OF POURTALES' HALIOTIS.

By JOHN B. HENDERSON,
Of the Smithsonian Institution.

During 1869 a series of dredgings were made under the direction of Count Pourtales by the U. S. Fish Commission steamer *Bibb* in the Straits of Florida. The mollusks obtained by the *Bibb* were sent to Washington, and thence, in due course of time, to William Stimpson in Chicago, to whose care they were intrusted for report and publication. Before Stimpson had entered upon this task the entire collection was destroyed in the great Chicago fire. While these shells were in Washington prior to their shipment to Chicago they were inspected by Dr. W. H. Dall, who was greatly interested and astonished to find among the lot a specimen of a *Haliotis*. No representative of this genus had ever before been reported from western Atlantic waters. The discovery, therefore, of a *Haliotis* from Florida was an event important enough to inspire a more than casual scrutiny of the specimen, and its main characters became impressed upon his mind.

Some 20 years later, when publishing a preliminary report upon the mollusks collected by the *Blake*, Doctor Dall described from his memory this lost *Haliotis*, naming it in honor of Count Pourtales. The locality given clearly indicates that the specimen was a resident of the rocky strip of bottom lying just off the Florida Reef and since referred to by Alexander Agassiz as the "Pourtales Plateau."

In 1889 Doctor Dall published a report upon the mollusca taken by the *Albatross* in a voyage made from Norfolk, Virginia, to California. In this report he refers with some hesitancy a *Haliotis* collected in the Galapagos to *H. pourtalesii* and adds a new description of the species based upon the new examples taken by the *Albatross*. These specimens are in the United States National Museum collection (Cat. No. 96392).

Two years ago, while dredging from the *Eolis* along the inner edge of the Pourtales Plateau off Key West in 90 fathoms, I had the ex-

treme good fortune to secure a *Haliotis*, although a small and somewhat immature specimen. Upon showing this to Doctor Dall, he at once pronounced it to be the true *Haliotis pourtalesii*, as the sight of the specimen itself refreshed his memory of the example taken so many years ago by Pourtales at about the same locality. A comparison with the Galapagos specimens above referred to immediately demonstrated the fact that the Atlantic and the Pacific "*pourtalesii*" were not the same, but, upon the contrary, very distinct species.

The importance of an east American representative of this essentially Pacific genus warrants a new description made from this unique specimen, now in the Museum collection (Cat. No. 271601). I give the following description and figure. The Galapagos Island species must receive a new designation. I take much pleasure in naming it in honor of Doctor Dall.

HALIOTIS (PADOLLUS) POURTALESII Dall.

Plates 45 and 46, upper figures.

1881. *Haliotis pourtalesii* DALL, Bull. Mus. Comp. Zool. Cambridge, vol. 9, No. 2, p. 79.
1889. *Haliotis pourtalesii* DALL, Bull. Mus. Comp. Zool. Cambridge, vol. 28, pp. 33 and 395.
1889. *Haliotis pourtalesii* DALL, Bull. U. S. Nat. Mus., No. 37, p. 168.
1903. *Haliotis pourtalesii* DALL, Bull. U. S. Nat. Mus., No. 37, p. 168. (Reprint.)
1911. *Haliotis pourtalesii* HENDERSON, Nautilus, vol. 25, No. 7, p. 81.
1914. *Haliotis pourtalesii* COOKE, Proc. Mal. Soc. London, vol. 11, pt. 2, p. 103.

Shell somewhat longer than wide. Holes 17, the last 5 open with prominent margins, the closed ones prominent and bulbous. Nucleus consisting of one full whorl, smooth. The characteristic sculpture begins with the postnuclear whorl in very fine spiral lines which develop gradually into sharply raised, irregularly waving, spiral threads with finer intercalated threads appearing and continuing to the edge of the aperture. At the end of the second whorl there are 10 of these threads between the suture and the line of holes; at the margin of the aperture, 23 to 27. Below the line of holes the threads are more widely spaced, the third one forming a decidedly angulated periphery. Base marked by four equal, equally spaced, spiral threads on the posterior half. Anterior half of the base smooth, excepting a slender spiral sulcus a little within the edge of the wide expanded aperture. The axial sculpture consists of rather regularly spaced lines of growth. Color wax yellow with deeper patches of orange; nacreous shining within.

Length, 11 mm.; width, 8 mm.

Dredged about 3 miles off Sand Key, Florida, in 90 fathoms, on sand patches among rocks, on the edge of the "Pourtales Plateau."

HALIOTIS (PADOLLUS) DALLI, new name.

Plates 45 and 46, lower figures.

1889. *Haliotis pourtalesii*? DALL, Proc. U. S. Nat. Mus., vol. 12, p. 355, pl. 12, figs. 1, 3.

1890. *Haliotis pourtalesii* PILSBRY, Man. Conch., ser. 1, vol. 12, p. 121, pl. 22, figs. 27, 28.

1893. *Haliotis pourtalesii*? STEARNS, Proc. U. S. Nat. Mus., No. 942, vol. 16, pp. 418, 448.

The following is Doctor Dall's description in full:

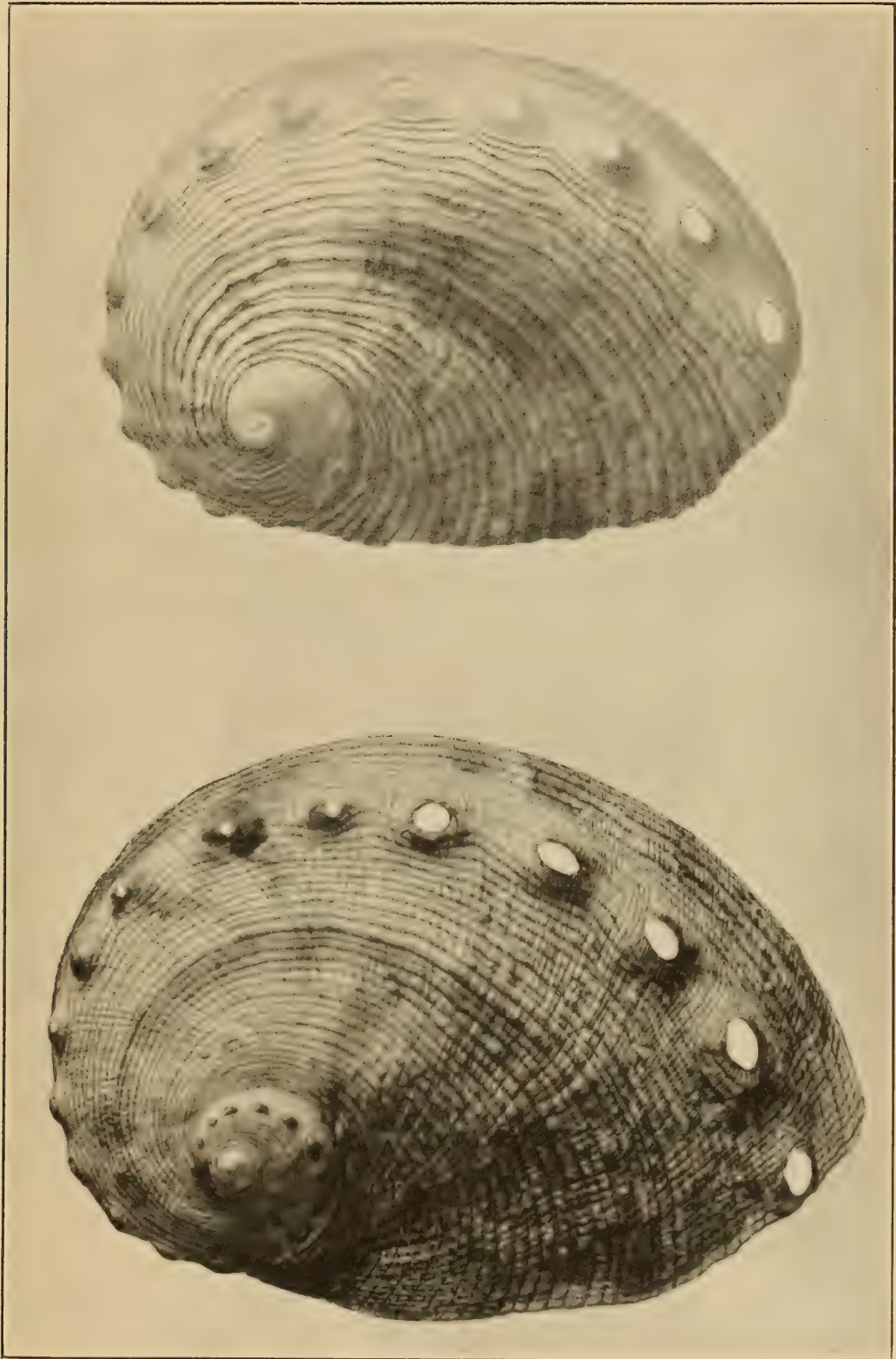
Shell small, of a pale brick-red color, with white dots on some of the spirals, rather elevated, with about $2\frac{1}{2}$ whorls; apex small, prominent; holes about 25, of which 5 remain open, the margins of these rather prominent; outside the row of holes the usual sulcus is strongly marked; about midway from the suture to the lines of holes is a raised rib, rather obscure but differing in different individuals and corresponding to an internal sulcus; between the central ridge and the suture there are no undulations or transverse ridges of consequence; sculpture of well marked, rather flattish, spiral, close-set threads, sometimes with a single finer intercalary thread, overlaid by smaller rather compressed transverse ridges, in harmony with the incremental lines; on top of the spirals the ridges bulge like the threads of worsted on canvas embroidery; spire situated well forward and with sub-vertical sides; interior pearly, the coil of the spire rather close and the margin of the pillar flattened. Longitude of shell, 23; latitude, 18; altitude, 11.5; nucleus behind the anterior end, 17 mm.

Hab.—Station 2815, in 33 fathoms, sand; near Charles Island, of the Galapagos group, in the Pacific.

The nearest relative of this shell is *H. parva*, from the Cape of Good Hope, which differs from our specimens chiefly in the greater prominence of the central rib, and in being a little more circular in outline.

The shell from the Galapagos agrees so exactly with what we know of *H. pourtalesii* and with my own recollection of the type specimen destroyed in the Chicago fire, that I am unwilling to separate it, though the distance between the two localities is so great.

The occurrence of this shell at the Galapagos is of great interest apart from its supposed connection with the Floridian species. No species of *Haliotis* is known from the west coast of South America, of Central America, or of North America south of northern Mexico. There are one or two small not nearly related species in the Melanesian Islands and north Australia. So the present species is remarkably isolated. Nothing of the sort has been previously reported from the Galapagos. Two specimens were obtained, neither containing the soft parts. The original type of *H. pourtalesii* contained the animal. It would probably be referred to the section *Padollus*.



OUTSIDE VIEWS OF HALIOTIS POURTALESII AND H. DALLI.

FOR EXPLANATION OF PLATE SEE PAGES 660 AND 661.



INSIDE VIEWS OF *HALIOTIS POURTALESII* AND *H. DALLI*.

FOR EXPLANATION OF PLATE SEE PAGES 660 AND 661.

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